Environmental Impact Analysis Process

Environmental Assessment
for
U.S. Air Force
atmospheric interceptor technology PROGRAM

November 1997

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FINDING OF NO SIGNIFICANT IMPACT (FONSI)
U.S. Air Force *atmospheric interceptor technology* Program

Pursuant to the National Environmental Policy Act (NEPA), the President's Council on Environmental Quality (CEQ) regulations implementing the Act (40 Code of Federal Regulations 1500-1508), Department of Defense (DoD) Regulation 5000.2-R and Air Force Instruction (AFI) 32-7061, which implements these regulations through the Environmental Impact Analysis Process (EIAP), the U.S. Air Force (USAF) has conducted an environmental assessment of the potential environmental consequences of the USAF *atmospheric interceptor technology* (*ait*) program. The No Action alternative was also considered. This Finding of No Significant Impact (FONSI) summarizes the results of the evaluation.

The USAF made its draft Environmental Assessment (EA) and draft FONSI available for public review and comment from October 3, 1997 through November 2, 1997. As the result of comments received from the public and interested government agencies with respect to the Draft EA (see Appendix E of the Final USAF *ait* EA), additional information has been included in the Final EA to address the concerns expressed in those comments.

Proposed Action and Alternatives: The attached Final EA is for the USAF *ait* program, which consists of two proposed sub-orbital missile launches. The United States Congress directed the Ballistic Missile Defense Organization (BMDO) to provide funds to support the USAF National Missile Defense (NMD) initiative. The USAF NMD initiative is to exploit existing missile and radar capabilities in support of the effort to develop a national missile defense system. The USAF plans to develop a target launch capability to realistically simulate inbound missile threat trajectories from potential Pacific Basin adversaries. In the interest of enhancing timely, economical national defense, this capability will be used to evaluate the performance and utility of existing radar systems to support potential low-cost, low-risk NMD architectures.

Two existing USAF radar systems have high potential for NMD application. The upgraded Precision Acquisition Vehicle Energy-Phased Array Warning System (PAVE PAWS) radar located at Beale Air Force Base (AFB), California is a wide-looking potential target detection element of a future NMD system. The HAVE STARE tracking radar located at Vandenberg AFB, California represents a candidate design to perform the narrow-looking target tracking radar role of a future NMD system. To fully understand the utility of these radar systems in an NMD role, the USAF plans to integrate and test these systems using realistic threat

scenarios. California is the only location where these radars are close enough to be tested together. The PAVE PAWS radar initially detects an incoming target and hands over specific tracking of the target to the HAVE STARE.

The proposed USAF *ait* program will consist of the preparation for and the launch of two sub-orbital test vehicles from the Kodiak Launch Complex (KLC) on Kodiak Island, Alaska. KLC will be the Alaska Aerospace Development Corporation (AADC) commercial launch site. Sub-orbital launches from this site can be detected and tracked by the PAVE PAWS and HAVE STARE radars in California. The USAF *ait* test vehicles consist of deactivated Minuteman II second and third solid rocket motor stages that have been modified to be used as boosters for the test launches. As part of the USAF *ait* program, the test vehicles would carry an instrumentation package. The two USAF *ait* sub-orbital launches are proposed for the period between July 1, 1998 to September 15, 1998 and in March 1999.

In addition to the proposed action, the USAF considered various other alternatives for launching the USAF *ait* test vehicles. These alternatives included sea and air launch systems; potential commercial launch sites; existing DoD launch sites; and sites in Alaska other than Kodiak Island. Based on the alternative selection criteria established by the USAF to meet the mission objectives of the USAF *ait* program, none of the alternatives meet all of the mission objectives. Therefore, the alternatives were eliminated from further detailed analysis.

Under the No Action alternative, the USAF *ait* program would not be conducted. Impacts associated with the processing and launch of the two sub-orbital USAF *ait* test vehicles would not occur. However, if the proposed action is not conducted, the existing operational, ground-based radar systems will not be tested regarding their capabilities to realistically detect, track, and evaluate simulated, inbound missile threat trajectories from potential Pacific Basin adversaries.

Anticipated Environmental Effects: The EA evaluated potential environmental impacts of the USAF *ait* test program. The two USAF *ait* test vehicles would be launched from KLC. The construction and operation of AADC's KLC site was the subject of an EA conducted by the Federal Aviation Administration (FAA). The FAA EA analyzed an 18 month construction period for the five KLC facilities. It also evaluated at least 20 years of subsequent launch operations, involving up to nine orbital launches per year. The FAA EA was completed in June 1996 and a FONSI was signed by the FAA in October 1996. The FAA EA has been reviewed regarding potential impacts to the geology and soils, water, land use, socioeconomics,

environmental justice, recreation, visual and cultural resources of Kodiak Island and the KLC site. The USAF adopts the analysis and conclusions of the FAA EA for these topical areas. The FAA is a cooperating agency for the USAF *ait* EA.

To address potential impacts specific to the processing and launch of the sub-orbital USAF *ait* test vehicle from KLC, the USAF *ait* EA includes an analysis of air quality, biological resources, noise, health and safety, and hazardous materials and waste. The USAF analysis focused on those aspects of the USAF *ait* sub-orbital launch operations that were not analyzed in the FAA EA. In addition, the USAF analyzed those circumstances that have changed since the FAA EA was finalized in June 1996. These include the reduction of the construction period from 18 months to 9 months, the designation of the Steller's eider seabird as a "threatened species," and the redesignation of the Steller sea lion from "threatened" to "endangered." The EA demonstrates that the USAF *ait* test program would not result in significant impact relative to air quality, biological resources, noise, health and safety, or hazardous materials and waste.

Monitoring and Mitigation:

Impacts to the Steller's eider:

The Steller's eider, a seabird commonly found in this area during the winter, was recently listed as a federal threatened species. In accordance with the Endangered Species Act, the USAF has completed informal Section 7 consultation with the U.S. Fish and Wildlife Service (USFWS) for the first USAF *ait* launch. In a letter dated October 28, 1997, the USFWS concurred with the USAF conclusion that the first proposed USAF *ait* launch is not likely to adversely affect threatened or endangered species, and stated that further consultation under Section 7 of the Endangered Species Act is not required at this time. USFWS's concurrence is based upon a proposed first launch date no earlier than July 01, 1998, and upon an USFWS approved, fully funded, statistically valid USAF surrogate seabird monitoring plan being in place prior to the first USAF *ait* launch. The specific monitoring requirements are set forth in the October 28, 1997, USFWS letter in Appendix D of the EA. Consultation pursuant to Section 7 of the Endangered Species Act will commence for the second launch (currently proposed for March 1999) within 30 days of the first launch, and will be based, in part, on the results of the monitoring efforts associated with the first launch. If the first launch is delayed past September 15, 1998, or if project plans change, additional information on listed or proposed species become available or new species are listed that may be affected by the project, the USAF will reinitiate consultation with the USFWS regarding the first USAF *ait* launch. Without the completion of the required additional consultation with, and approval by, the USFWS, the USAF will not conduct the first launch between September 15, 1998 and April 01, 1999 to avoid the

first launch occurring while the threatened Steller's eiders are present. The second launch will be conducted in accordance with the USFWS consultations regarding results of the monitoring that occurred prior to, during and after the first launch, so as to avoid adversely affecting threatened or endangered species.

Impacts to marine mammals, including Steller sea lions (a federally listed endangered species): In a letter dated October 24, 1997, and in subsequent conversations, the National Marine Fisheries Service (NMFS) concurred with the USAF's opinion that predicted launch and overflight noise from the USAF ait launches will not have significant effects on marine mammals. However, because this is based on predicted rather than measured noise levels, NMFS has requested and the USAF has agreed to perform NMFS approved monitoring of Steller sea lion haulout before, during and after the first USAF *ait* launch. This monitoring will be similar to that described above with regard to the Steller's eider. As with the Steller's eider, the second launch will be conducted in accordance with consultation with NMFS regarding the monitoring results from the first launch, so as to avoid adversely affecting threatened or endangered marine mammals. In addition, the USAF will not conduct either USAF *ait* launch during the peak gray whale migrating periods of April 01 through May 31 and November 01 through December 31 without prior consultation with, and approval by NMFS.

Finding: Following a review of the attached EA, I find that the USAF *ait* program, including the mitigation measures described above, will not result in significant environmental impacts. Therefore an Environmental Impact Statement (EIS) is not required for the USAF *ait* program. This document, and the supporting EA, fulfill the requirements of NEPA, CEQ regulations, and AFI 32-7061.

Approved:

Helmut Hellwig

HELMUT HELLWIG
Deputy Assistant Secretary
(Science, Technology and Engineering)

19 Nov 97
Date

ENVIRONMENTAL ASSESSMENT
U.S. AIR FORCE
atmospheric interceptor
technology PROGRAM

Department of the Air Force
Headquarters Space and Missile Systems Center/AXFV
Los Angeles Air Force Base, California

November 1997

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LIST OF ACRONYMS AND GLOSSARY OF TECHNICAL TERMS

ACRONYMS

ait	*atmospheric interceptor technology*
$A1_20_3$	Aluminum oxide
AADC	Alaska Aerospace Development Corporation
AFB	Air Force Base
AFI	Air Force Instruction
BMDO	Ballistic Missile Defense Organization
C	Celsius
CEQ	Council on Environmental Quality
Cl_2	Chlorine
CO	Carbon monoxide
dB	decibel
dBA	decibel (A-Weighted Sound Level)
DoD	Department of Defense
DOT	Department of Transportation
EA	Environmental Assessment
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
ft/s	feet per second
HCl	Hydrogen chloride
GBI	Ground Based Interceptor
KLC	Kodiak Launch Complex
KOH	Potassium hydroxide
km	kilometers
lbs	pounds
m/s	meters per second
mg/m^3	milligrams per cubic meter
NAWC	Naval Air Warfare Center Weapons Division
NEPA	National Environmental Policy Act
NMD	National Missile Defense
NMFS	National Marine Fisheries Services
NO	Nitrogen oxide

NOAA	National Oceanic and Atmospheric Administration
NO_x	Nitrogen oxide
ODS	ozone depleting substances
PM_{10}	Particulate matter (aerodiameter less than 10 microns)
PAVE PAWS	Precision Acquisition Vehicle Energy - Phased Array Warning System
ppb	parts per billion
ppm	parts per million
psf	pounds per square foot
REEDM	Rocket Exhaust and Effluent Diffusion Model
RF	Radio Frequency
SFA	Spaceport Florida Authority
SMC/TEB	Space and Missile Systems Center, Test and Evaluation Directorate, Launch Test Program
SSI	Spaceport Systems International
T	Launch Time
USEPA	United States Environmental Protection Agency
USAF	United States Air Force
USFWS	United States Fish and Wildlife Service

GLOSSARY

2-Nitrodiphenylamine (2-NDPA)	Part of the M57 propellant, 1.00% of propellant by weight.
Abort	To end a planned missile flight before it is completed.
Acoustic	Refers to hearing and sound.
Air Force Instruction (AFI)	Air Force publication providing instruction.
Aloft	Winds aloft for Range Safety refer to winds in excess of 30,000 feet.
Altitude	The height above sea level.
Aluminum	Part of the SR-19 propellant.
Ambient	Completely around; circulating, as “ambient air .”
Ammonium Perchlorate	The oxidizer for the SR-19 and M57 propellant, 73 percent of propellant weight for SR-19 and 10.80 percent of propellant by weight for M57.
Amplitude	The height (or magnitude) of a wave form about a given axis.
Apogee	The point in an orbit that is the farthest distance from the earth.
Attenuation	To weaken or reduce; to become less.

Atomic Chlorine (Cl-)	A chlorine ion.
Auditory Trauma	Injury to a person's or animal's organs of hearing.
Azimuth	The direction the vehicle will travel about the launch point.
Bird Strikes	When a bird flies into a solid object.
Black Scoter	Sea bird common to the Narrow Cape area.
Boosters	Sources of thrust in the takeoff and early flight of a rocket.
Cadmium	A heavy metal used in the rocket batteries.
Carpet Boom	Sonic boom during descent of an airborne vehicle that is traveling faster than the speed of sound.
Celsius	Centigrade scale of temperature.
Clean Air Act	Federal legislation enacted in 1955 that governs substances discharged into the air.
Combustion Chamber	The area within a liquid rocket motor where the fuels combine, burn and develop thrust.
Cultural Resources	Historic and archaeological remains and artifacts.
Cyclotetramethylentetranitramine (HMX)	Part of M57 propellant, 10.80 percent of propellant by weight.
Debris Scatter	Fragments of an exploded rocket, spread over a large area.
Environs	Surrounding parts or areas.
Evacuate	To remove persons or things from a place, especially for reasons of safety.
Explosion	A violent expansion or bursting of noise.
EIS	Environmental Impact Statement. A federal environmental document.
Focal Zone	The leading edge of the missile from which a sonic boom originates.
FONSI	Finding of No Significant Impact. A decision that a project will not have a significant effect on the environment.
General Vicinity	Near.
Gravitational	The effect of gravity, which causes things to fall toward the earth.
Haulout Area	An area where marine animals, such as sea lions, come from the ocean onto the shore.
HAVE STARE	A research and development radar located on Vandenberg AFB, CA, used for tracking missiles.
Hydraulic Fluid	A fluid usually of low viscosity, as or, used in a hydraulic system.

Hypergolic	Rocket fuel that combusts upon the mixing of a liquid fuel and liquid oxidizer.
Impact Zones	Areas where effects would occur.
Inbound	Moving toward a person or place.
Individuals	Each one of a group of persons, animals or things.
Intercontinental	Between the earth's continents. Able to travel from one continent to another.
Instrumentation Package	Front, or top, section of the *ait* vehicle that holds the various experiments.
Kilometer	A metric measure of distance that is 0.621 of one mile.
Launch Trajectory	The curve or path of a rocket in flight.
Launch Vehicle	Rocket that carries cargo into the air.
Minuteman II	A three-stage rocket developed by the U.S. Air Force.
Milligram	A unit of weight equal to 1/1,000 of a gram.
Missile Transporter Erector	A trailer designed to transport a two-stage (SR-19/M57) rocket and lift it vertically onto a fixed launch stool.
Molecular Chlorine (Cl_2)	Two atoms of chlorine in its natural gaseous state.
Navy NP-3D Orion Aircraft	A modified Navy P-3 aircraft that can track a missile, collect telemetry for a missile and (if the missile goes off course) initiate a destruct command that will cause the missile to stop acceleration.
Nickel	Metallic element used in the rocket batteries.
Nitrocellulose	Part of M57 propellant.
Nitrogen Oxide	A compound that contains nitrogen and oxygen.
Nitroglycerin	An explosive liquid. Part of M57 propellant.
Nominal Conditions	Flight conditions that occur as predicted.
NP-3D Orion	See Navy 2P-3D Orion Aircraft.
Oldsquaw	Seabird common to the Narrow Cape area.
Operational Threat Trajectories	Flight profiles that would be expected from a missile launch toward the U.S.
Ordnance	Military weapons and ammunition.
Ozone	A form of oxygen that helps protect the earth from the sun's rays.
Ozone Depleting Substances, Class I and Class II	Chemical matter that decreases the earth's ozone layer. Class I and II substances are as listed in Section 602 of the Clean Air Act (1990 amendments).

PAVE PAWS	An operational radar (Precision Acquisition Vehicle Energy-Phased Array Warning System) located on the central California coast used for tracking friendly and enemy missiles.
PCBOOM 3 Model	U.S. Air Force computer software used to predict and measure a sonic boom.
Pelagic Species	Marine plants or animals that live or grow at or near the surface of the ocean, far from land.
Plume Size and Drag	The size of the rocket exhaust and how much it slows down the rocket.
Polybutadiene (as binder)	Part of the SR-19 propellant, 12 percent of propellant by weight.
Postbreeding	The time after animals have finished breeding.
Potassium Hydroxide (KOH)	Caustic substance used in one of the seven batteries onboard the *ait* test vehicle.
Propagate	To transmit through space.
Radar	A device that determines the location of a solid object by using radio waves that "bounce" off of the object.
Range Control	The range safety organization function of controlling the flight of a rocket to ensure it stays on course.
Range Safety Program	Range function to ensure that all aspects of a missile launch and flight are done safely, including ground handling and missile flight.
Redundant Airborne Command Destruct Systems	All systems on the Navy NP-3D Orion have two systems for the command destruct function. If one system goes down, the second can complete the command destruct function.
Resorcinol	Trade name for an element of the M57 propellant, 1.08 percent of propellant by weight. Chemical name 1,3-Dihydroxybenzene.
RNOISE Model	U.S. Air Force computer software used to predict and measure on-pad and in-flight rocket noise.
Roadblocks	Large objects placed in a road to keep persons from driving on the road.
Rocket Exhaust and Effluent Dispersion Model (REEDM)	Computer software that measures air pollutants from rocket exhaust.
Rookery	A place where animals, such as seals and sea lions, breed.
Scoping Process	Procedures that let the general public learn about and make comments on the environmental effects of a proposed project.
Second Stage	The second rocket motor to fire.
Service Structure	Mechanism that lifts the rocket to an upright position so that it can be launched.

Socioeconomics	The interaction of persons and monetary issues within a society.
Solid Rocket Motor	Engine for rocket with fuel that is solid, not liquid.
Sonic Boom	A loud noise caused by the shock wave of a vehicle that is traveling faster than the speed of sound.
Startle	To be surprised; to act surprised.
Steller's eider	Sea bird common to the Narrow Cape area.
Stratosphere	A part of the earth's atmosphere. It surrounds the earth on top of the troposphere and extends outward to about 15 miles from the earth's surface.
Sub-Orbital	Below an altitude necessary for an object to achieve an orbit, which is a path around the earth or other celestial body.
Surf Scoters	Sea bird common to the Narrow Cape area.
Surf Zone	The area near the shore where there is foamy water from waves breaking on the shore.
Topography	The contours, such as mountains and canyons, of the surface of the ground.
Toxic Materials	Substances that can be poisonous.
Trajectory	The curved path of a rocket in flight.
Triacetin	Part of the M57 propellant, 6.16 percent of propellant by weight.
Troposphere	A part of the earth's atmosphere. It surrounds the earth and extends from the surface of the earth to a distance ranging from 6 to 12 miles from the earth.
Vector	Instantaneous missile direction and velocity of the missile in flight.
Velocity	Speed of an object in motion.
White-Winged Scoters	Sea bird common to the Narrow Cape area.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

1. This Environmental Assessment (EA) is for the United States Air Force (USAF) *atmospheric interceptor technology (ait)* program, which consists of two proposed sub-orbital missile launches. The United States Congress directed the Ballistic Missile Defense Organization (BMDO) to provide funds to support the USAF National Missile Defense (NMD) initiative. The USAF NMD initiative is to exploit existing missile and radar capabilities in support of the effort to develop a national missile defense system. The USAF plans to develop a target launch capability to realistically simulate inbound missile threat trajectories from potential Pacific Basin adversaries. In the interest of enhancing timely, economical national defense, this capability will be used to evaluate the performance and utility of existing radar systems to support potential low-cost, low-risk NMD architectures.

2. Two existing USAF radar systems have high potential for NMD application. The upgraded Precision Acquisition Vehicle Energy - Phased Array Warning System (PAVE PAWS) radar located at Beale Air Force Base (AFB), California is a wide-looking potential target detection element of a future NMD system. The HAVE STARE tracking radar located at Vandenberg AFB, California represents a candidate design to perform the narrow-looking, target tracking radar role in a future NMD system. To fully understand the utility of these radar systems in an NMD role, the USAF plans to integrate and test these systems using realistic threat scenarios. California is the only location where these radars are close enough to be tested together. The PAVE PAWS radar initially detects an incoming target and hands over specific target tracking to the HAVE STARE.

3. Space and Missile Systems Center, Test and Evaluation Directorate, Launch Test Programs (SMC/TEB) proposes to launch two sub-orbital test vehicles as part of the USAF *ait* program to test these existing ground-based early warning radar systems with authentic inbound rockets, flying from north to south as they would if used in an actual attack.

4. The Environmental Impact Analysis Process (EIAP) for the proposed program is set forth in Air Force Instruction (AFI) 32-7061, Environmental Impact Analysis Process, which implements the National Environmental Policy Act (NEPA) and the President's Council on Environmental Quality (CEQ) regulations. Additional NEPA requirements are contained in Department of Defense (DoD) Regulation 5000.2, Mandatory Procedures for Major Defense Acquisition Programs.

5. This EA evaluates available DoD and commercial launch capabilities that could support the launch of the USAF *ait* test vehicles while meeting the test objectives of the program. The USAF included the evaluation of commercial launch sites to support the objectives of the Commercial Space Launch Act. The Commercial Space Launch Act encourages "…strengthening and expansion of the U.S. space transportation infrastructure, including the enhancement of U.S. launch sites and launch site support facilities, with Government, State, and private sector involvement." [49 U.S.C. § 70101(b)(4)] In 1995, SMC/TEB awarded a Spaceport Contract for the purpose of providing competitive, commercial spaceport services to support potential SMC/TEB launch operations for both orbital and sub-orbital missions. At the time the contract was awarded, none of the contract awardees had existing launch facilities. The contract awardees are the Alaska Aerospace Development Corporation (AADC); Spaceport Systems International (SSI), California; Old Dominion University Research Facility, Virginia; and Spaceport Florida Authority (SFA). The USAF would be a commercial "customer" of AADC for this proposed action. The USAF would be solely responsible for the two USAF *ait* launches, to include range safety. The USAF is not involved in the construction or operation of the Kodiak Launch Complex (KLC).

6. Several potential alternatives were considered but eliminated from further detailed analysis in this EA based upon selection criteria developed for this proposed action. Based on the evaluation of potential alternatives, only the AADC commercial spaceport on Kodiak Island, Alaska, will meet the selection criteria for the USAF *ait* program. The construction and operation of AADC's KLC was the subject of an EA conducted by the Federal Aviation Administration (FAA). The FAA EA for KLC was completed in June 1996 and a Finding of No Significant Impact (FONSI) (Attachment 1) was signed for the KLC site by the FAA in October 1996. To avoid a repetitive discussion of the environmental issues associated with AADC's construction and operation of KLC previously discussed in the FAA EA, and to focus the USAF decision making process on the issues associated with the USAF *ait* program, the USAF adopts the FAA EA analysis and findings regarding the construction and operation of KLC. The FAA is a cooperating agency for the USAF *ait* EA. The location of the KLC site is shown in Figure 1.1.

7. To support the launch of USAF *ait* test vehicles, the USAF will use the following facilities at KLC: Launch Control and Management Center, Launch Pad and Service Structure, and Integration and Processing Facility. These facilities will be designed and constructed by AADC.

8. This EA identifies, describes and evaluates the potential direct, indirect and cumulative environmental impacts of activities associated with the proposed launch by the USAF of two *ait* sub-orbital test vehicles. This EA also identifies other alternatives to the proposed action, including the No Action alternative, and describes mitigation measures necessary to prevent or minimize environmental effects. To address potential impacts specific to the processing and launch of the USAF *ait* test vehicle from KLC, the USAF *ait* EA includes an analysis of air quality, biological resources, noise, health and safety, and hazardous materials and waste. The USAF analysis focused on those aspects of the *ait* sub-orbital launch operations that were not analyzed in the FAA EA. In addition, the USAF analyzed those circumstances that have changed since the FAA EA was finalized in June 1966. These include the reduction of the construction period from 18 months to 9 months, the designation of the Steller's eider seabird as a "threatened species," and the redesignation of the Steller sea lion from "threatened" to "endangered." Based upon their review of this EA, the USAF decision makers will determine whether the EA supports a FONSI or whether an Environmental Impact Statement (EIS) is required due to the potential of the proposed action to have significant environmental impacts.

9. Public health and safety is of paramount importance to this program. Therefore, to eliminate physical risk to the public, areas that could be impacted in the event of a major launch failure will be evacuated. The evacuation area is expected to include up to a 10,000-foot radius around the launch pad. However, further detailed analysis for the two USAF *ait* launches may favor the use of a smaller exclusion zone. The brief evacuation time period will extend for approximately four hours before launch to no more than one hour after launch. In the case of KLC, this would include the road providing access to Narrow Cape.

10. The following environmental laws and Executive Orders were among those considered during the preparation of this EA:
    - National Environmental Policy Act
    - Endangered Species Act, as amended
    - Marine Mammal Protection Act
    - Clean Air Act, as amended
    - Archaeological Resources Protection Act
    - Clean Water Act
    - Marine Protection, Research and Sanctuaries Act
    - National Historic Preservation Act
    - Occupational Safety and Health Act
    - Pollution Prevention Act
    - Executive Order 11990, Protection of Wetlands
    - Executive Order 12898, Environmental Justice
    - Executive Order 12114, Environmental Effects Abroad of Major Federal Actions

CHAPTER 1.0
INTRODUCTION

1.0 INTRODUCTION

1.1 NEED AND PURPOSE FOR THE PROPOSED ACTION

1.1.1 NEED

1. To enhance the national defense, the USAF plans to test its existing ground-based radar systems for detecting potential inbound missile threats. To accomplish this, the USAF must realistically simulate inbound missile threat trajectories from potential Pacific Basin adversaries. To meet this requirement, the USAF proposes the USAF *ait* program, with test objectives that mandate a trajectory that is capable of specific azimuths and altitudes to provide a threat-like scenario to existing operational ground-based radars. These operational ground-based radars will observe and evaluate the simulated inbound threat trajectory of the USAF *ait* sub-orbital test vehicles.

2. Two existing USAF radar systems have high potential for NMD application. The upgraded PAVE PAWS radar located at Beale AFB, California is a wide-looking potential target detection element of a future NMD system. The HAVE STARE tracking radar located at Vandenberg AFB, California represents a candidate design to perform the narrow-looking, target tracking radar role in a future NMD system. To fully understand the utility of these radars in an NMD role, the USAF plans to integrate and test these systems using realistic threat scenarios. California is the only location where these radars are close enough to be tested together. The PAVE PAWS radar initially detects an incoming target and hands over specific target tracking to the HAVE STARE.

1.1.2 PURPOSE

The purpose of the proposed action is to evaluate the performance and utility of existing radar systems to support potential low-cost, low-risk NMD architectures. This is the USAF NMD initiative. Testing the operational ground-based radar system requires the launch of a test vehicle that can be simultaneously detected and tracked by both systems. The USAF *ait* program will allow the evaluation of the systems' capabilities to simultaneously acquire and accurately track the test vehicle and to manage data.

1.2 ALTERNATIVE SELECTION CRITERIA

To support the USAF *ait* program, an alternative must meet the following criteria:

- Radar Coverage: Must allow simulation of inbound hostile threat trajectories, and confirm the ability of existing U.S. early warning PAVE PAWS and HAVE STARE radar sites in California to detect the test vehicle.
- Overflight: Must avoid overflight of populated areas and minimize overflights of environmentally sensitive areas.
- Logistics: Must be supportable year-round using existing transportation infrastructure, such as air cargo and barge systems.
- Weather: Must provide weather conditions compatible with the launch of sub-orbital solid rocket motor test vehicles.
- Range: Must provide launch capability within a maximum of 2,000 kilometers (km) from the radar coverage area to accommodate the range of the two-stage USAF *ait* test vehicle and to provide desired trajectories into the early warning radar coverage.
- Launch Capability: Must be capable of using the existing proven, low-cost, low-risk USAF *ait* test vehicle.

1.3 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

1. Requirements of NEPA and the implementing regulations of the President's CEQ require federal agencies (e.g., the USAF) to evaluate the impact that their proposed actions would have on the environment. The purpose of this EA is to fulfill those requirements for the USAF *ait* program and to make the USAF decision makers aware of potential environmental consequences of proposed action and alternatives.

2. Several potential alternatives were considered but eliminated from further detailed analysis in this EA based upon selection criteria described above developed for this proposed action. As explained more fully below, based on the evaluation of potential alternatives, only the AADC commercial spaceport on Kodiak Island, Alaska, will meet the selection criteria for the USAF *ait* program. The construction and operation of AADC's KLC was the subject of an EA conducted by the FAA. The FAA EA for KLC was completed in June 1996 and a FONSI (Attachment 1) was signed for the KLC site by the FAA in October 1996. To avoid a repetitive discussion of the environmental issues associated with AADC's construction and operation of KLC previously discussed in the FAA EA, and to focus the USAF decision

making process on the issues associated with the USAF *ait* program, the USAF adopts the FAA EA analysis and findings regarding the construction and operation of KLC. The FAA is a cooperating agency for the USAF *ait* EA. The location of the KLC site is shown in Figure 1.1.

3. To assist in identification of the scope of the EA for the USAF *ait* program, the USAF conducted a scoping process to solicit input from the public regarding issues that were considered during preparation of the EA. Through a series of public announcements, press releases, purchased newspaper display advertisements that appeared in the *Kodiak Daily Mirror*, on August 18 and September 3, 1997 (see Appendix A) and an Internet notice, the USAF requested review and comment from the public. A summary of the issues raised during the scoping process is provided in Appendix A of this USAF EA. In addition to the public scoping process, the USAF consulted with federal and state agencies.

4. Potential impacts associated with the two sub-orbital launches of the USAF *ait* test vehicles are identified and analyzed herein. In addition to the FAA EA, this EA addresses environmental impacts associated with the launch of two USAF *ait* test vehicles, including an analysis of air quality, biological resources, noise, health and safety, and hazardous materials. This analysis will result in either a FONSI or a finding that an EIS must be prepared.

1.4 DECISION TO BE MADE

The decision to be made regarding the USAF *ait* program is whether to:

- Proceed with the two sub-orbital launches of the USAF *ait* test vehicle from KLC to challenge the existing ground-based radar systems' ability to rapidly acquire and accurately track the test vehicle, as well as the systems' capabilities to manage data.
- Take no action (i.e., No Action alternative) and not launch the two USAF *ait* test vehicles and not conduct the test of the existing ground-based radar system.

1.5 PERMITS, APPROVALS AND CONSULTATIONS

1. The FAA and AADC have or are obtaining various permits and approvals for operation of the KLC. Table 1.1 lists these permits and approvals pertinent to the USAF *ait* program.

The USAF is working directly with FAA and with the appropriate agencies (U.S. Fish and Wildlife Service [USFWS] and National Marine Fisheries Service [NMFS]) to assure that the *ait* program is in compliance with federal and state regulations, including the permits and approvals obtained by AADC.

2. Section 7 of the Endangered Species Act requires federal agencies to consult with the USFWS to determine if their actions have the potential to impact threatened or endangered species. Based on the recent listing of the Steller's eider as a threatened species, the USAF has completed informal Section 7 consultation with the USFWS for the USAF *ait* program. In addition, the USAF has completed informal consultation with the NMFS regarding the Steller sea lion, which NMFS reclassified from threatened to endangered effective June 1997.

3. The USAF is also addressing the issues of air space and maritime traffic. The USAF is coordinating with the FAA regarding commercial airspace corridors, and the FAA is a cooperating agency for this EA. The USAF is working with the U.S. Coast Guard on maritime traffic impacts.

CHAPTER 2.0
DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES (DOPAA)

2.1 PROPOSED ACTION

1. The proposed USAF *ait* program consists of the launch of two sub-orbital test vehicles from the AADC's KLC on Kodiak Island, Alaska. The two launches of the USAF *ait* test vehicle would realistically simulate potential incoming missile threat trajectories to allow the USAF to evaluate its early warning ground-based system for potential incoming missile attacks on the United States. As part of the USAF *ait* program, the test vehicle would carry an instrumentation package.

2. The first USAF *ait* launch is proposed for the period between July to September 1998 with the second launch proposed for March 1999.

3. The location of Kodiak to launch the two sub-orbital USAF *ait* test vehicles is proposed because it meets the USAF *ait* program selection criteria. The proposed USAF *ait* launches would occur from AADC's KLC. The KLC site is located on the eastern shore of Kodiak Island on Narrow Cape, approximately 40 miles south of the City of Kodiak, Alaska (see Figures 2.1 and 2.2).

4. The Commercial Space Launch Act encourages "…strengthening and expansion of the U.S. space transportation infrastructure, including the enhancement of U.S. launch sites and launch site support facilities, with Government, State, and private sector involvement." [49 U.S.C. §70101(b)(4)] In 1995, SMC/TEB awarded a Spaceport Contract for the purpose of providing competitive, commercial spaceport services to support potential SMC/TEB launch operations for both orbital and sub-orbital missions. At the time the contract was awarded, none of the contract awardees had existing launch facilities. The contract awardees are the AADC; Spaceport Systems International (SSI), California; Old Dominion University Research Facility, Virginia; and Spaceport Florida Authority (SFA). The USAF would be a commercial "customer" of AADC for this proposed action. The USAF would be solely responsible for the two USAF *ait* launches, to include range safety. The USAF is not involved in the construction or operation of the KLC.

2.1.1 LAUNCH VEHICLE AND TRAJECTORY

1. The USAF *ait* test vehicle is approximately 37 feet long, weighs 21,910 pounds and consists of deactivated Minuteman II second and third solid rocket motor stages. These stages have been modified to be used as boosters for the test launches. DoD has launched eight vehicles with a configuration similar to the USAF *ait* test vehicle, all of which were successful. Based on public comments on the Draft EA, the following information is provided: The other vehicles launched by DoD were seven U.S. Army Hera vehicles and one Ground Based Interceptor (GBI).

2. The USAF *ait* vehicle flight profile is a sub-orbital ballistic trajectory that is approximately 1,820 km in range with an apogee of 810 km (see Figure 4.4-3). At the end of the flight, the USAF *ait* instrumentation package would splash down into the Pacific Ocean approximately 300 km off the coast of southern Washington state. The first stage of the USAF *ait* test vehicle would separate at launch time (T)+60 seconds. The expended first stage would impact in the Pacific Ocean approximately 300 km downrange. The second stage would release the instrumentation package at launch T+123 seconds and would impact in the Pacific Ocean just short of the instrumentation package splashdown point. The instrumentation package would continue coasting until splashdown at T+1,022 seconds. The maximum vehicle velocity would be approximately 13,000 feet per second (ft/s) or Mach 14. Impact velocity would be approximately 800 ft/s.

2.1.2 VEHICLE PROCESSING

The following process would be followed to transport the USAF *ait* test vehicles to KLC and ready the vehicles for launch:

- The USAF *ait* test vehicle would be configured at Hill AFB, Utah.
- The USAF *ait* test vehicles would be placed in a Missile Trailer (Rocket Motor Semi-Trailer) and transported by a C-5 or C-17 aircraft from Hill AFB to the Kodiak Airport.
- The Missile Trailer is highway approved. A certified commercial carrier would be contracted to transport the Missile Trailer containing the USAF *ait* test vehicle from the Kodiak Airport to the KLC site via Kodiak Island Highway and Pasagshak Point Road (see Figure 2.1).
- A modified Missile Transporter Erector would be delivered to Kodiak by aircraft or barge and would be driven to KLC.

- The USAF *ait* instrumentation package would be transported to Kodiak via aircraft and transported to KLC by truck. Upon arriving at KLC, it would be placed in the Integration and Processing Facility for prelaunch processing. The instrumentation package would be integrated with the USAF *ait* test vehicle in the Integration and Processing Facility.
- In the Integration and Processing Facility, the USAF *ait* test vehicle would be removed from the Missile Trailer and placed in the Transporter Erector. The Transporter Erector would move into place at the Launch Pad/Service Structure and erect the USAF *ait* test vehicle onto the launch stool.
- Final testing and checkout of the integrated USAF *ait* test vehicle and instrumentation package would be completed in the Service Structure at the Launch Pad.
- Upon completion of processing, the USAF *ait* test vehicle would be launched. Range safety for the USAF *ait* launches would be provided by the Naval Air Warfare Center (NAWC) safety office at Point Mugu, California. The Navy would use NP-3D Orion aircraft to provide range safety functions for the USAF *ait* test vehicle launches. In addition to range safety support provided by the Navy, USAF personnel and equipment will be certified to accomplish range safety operations.

2.2 KLC FACILITIES

2.2.1 FACILITY OVERVIEW

The USAF proposes to launch two USAF *ait* test vehicles from AADC's KLC. The KLC will occupy 43 acres on a 3,100-acre parcel of state owned property. Facilities that will be constructed by AADC will consist of a Launch Control and Management Center (see Figure 2.3), Payload Processing Facility (see Figure 2.4), Integration and Processing Facility, and Launch Pad and Service Structure (see Figure 2.5). Support facilities at KLC will include access roads, water, power, communications and sewage disposal. For a more detailed discussion of the KLC launch site and its facilities, the reader is referred to the FAA EA included as Attachment 1 to this USAF EA.

2.2.2 CONSTRUCTION OF KLC

AADC is responsible for design and construction of the three facilities (i.e., Launch Control/Management Center, Integrated and Processing Facility, and Launch Pad/Service Structure) that are proposed to be used by the USAF *ait* program. Construction of the KLC

facilities and infrastructure is addressed in detail in the FAA EA that is included as Attachment 1 to this USAF EA. However, the FAA EA analyzed construction of the KLC facilities and infrastructure over an approximate 18-month period. AADC now advises that construction can be completed no later than September 1, 1998.

2.3 ALTERNATIVES

In addition to the proposed action, the USAF considered various other alternatives for launching the USAF *ait* test vehicles. However, these alternatives were eliminated from further detailed analysis in this EA as they did not meet the selection criteria outlined in Section 1.2. The following sections provide a summary of these alternatives and the reason they were eliminated from further detailed analysis.

2.3.1 ALTERNATIVES CONSIDERED BY THE USAF, BUT ELIMINATED FROM DETAILED ANALYSIS

1. USAF considered ground, sea, and air launch systems. Sea and air launches were eliminated because they did not meet the selection criteria of using existing proven, low-risk, low-cost USAF assets.

2. The USAF evaluated the five existing DoD launch sites as possible alternatives located outside the state of Alaska for launching the sub-orbital USAF *ait* test vehicle (Figure 2.6). As shown in Table 2.1 and as summarized below, none of the DoD existing launch site can meet all of the USAF *ait* mission siting criteria.
   - Wake Island: This site is not within the range to launch the USAF *ait* test vehicle into the radar coverage of the ground-based radar systems in California that are to be tested by the USAF *ait* program.
   - Kauai, Hawaii (Barking Sands): This site is not within range to launch the USAF *ait* test vehicle into the radar coverage of the ground-based radar systems in California that are to be tested by the USAF *ait* program. In addition, launching the USAF *ait* test vehicle from this site would result in overflight of populated areas in Hawaii.
   - White Sands, New Mexico: This site cannot launch the USAF *ait* test vehicle into the radar coverage of the ground-based radar systems in California that are to be tested by the USAF *ait* program. Launches would also overfly populated areas.

- Eastern Test Range, Florida: This site is not within range and cannot launch the USAF *ait* test vehicle into the radar coverage of the ground-based radar systems in California that are to be tested by the USAF *ait* program. In addition, launches would overfly populated areas.
- Western Test Range, California: This site cannot launch the USAF *ait* test vehicle into the radar coverage of the ground-based radar systems in California at a trajectory that would simulate a potential inbound missile threat.

Therefore, the use of the existing DoD launch sites for launching the USAF *ait* test vehicle was eliminated from further consideration.

3. The USAF also evaluated four sites other than Kodiak Island within the state of Alaska (see Figure 2.7) using the same criteria as the sites outside of the state. As shown in Table 2.2 and as summarized below, the USAF concluded that only Kodiak Island in the state of Alaska meets the USAF *ait* mission siting criteria.

   - Poker Flats: This site is not within range and cannot launch the USAF *ait* test vehicle into the radar coverage of the ground-based radar systems in California that are to be tested by the USAF *ait* program. In addition, launches would overfly populated areas.
   - Elmendorf AFB: This site would result in the overflight of populated areas of Alaska.
   - Point Barrow: This site would result in the overflight of populated areas of Alaska and cannot launch the USAF *ait* test vehicle into the radar coverage of the ground-based radar systems in California that are to be tested by the USAF *ait* program. In addition, Point Barrow does not provide year-around access to transportation infrastructure.
   - Adak Island: This site is not within range and cannot launch the USAF *ait* test vehicle into the radar coverage of the ground-based radar systems in California that are to be tested by the USAF *ait* program. This site does not provide year-around access to transportation infrastructure.
   - Kodiak Island-Narrow Cape: This site meets all of the USAF *ait* mission siting criteria.

   Therefore, with the exception of Kodiak Island-Narrow Cape, the other sites in Alaska were eliminated from further consideration.

4. Based on the above, AADC's KLC on Kodiak Island is proposed as the site to launch the USAF *ait* test vehicle.

2.3.2 NO ACTION ALTERNATIVE

Under the No Action alternative, the USAF *ait* program would not be conducted. Impacts associated with the processing and launch of the two sub-orbital USAF *ait* test vehicles would not occur. If the proposed action is not conducted, the existing operational, ground-based radar systems will not be tested regarding their capabilities to realistically detect, track, and evaluate simulated, inbound missile threat trajectories from potential Pacific Basin adversaries.

CHAPTER 3.0
AFFECTED ENVIRONMENT

3.0 AFFECTED ENVIRONMENT

3.1 GEOLOGY AND SOILS, WATER, LAND USE, SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, RECREATION, VISUAL AND CULTURAL RESOURCES

The FAA EA has been reviewed by the USAF regarding the existing geology and soils, water, land use, socioeconomics, environmental justice, recreation, visual and cultural resources of Kodiak Island and the proposed KLC site, the area potentially affected by the proposed processing and launch of the USAF *ait* test vehicle. The USAF adopts those portions of the FAA EA describing the existing environment regarding geology and soils, water, land use, socioeconomics, environmental justice, recreation, visual and cultural resources. The FAA EA is included as Attachment 1 to this USAF EA.

3.2 AIR QUALITY

1. The FAA EA has been reviewed regarding the existing air quality at Kodiak Island and the proposed KLC site, the area potentially affected by the proposed processing and launch of the USAF *ait* test vehicle. The USAF adopts those portions of the FAA EA describing the existing environment regarding air quality. It has been determined that the air quality analysis provided in the FAA EA on construction and pre/postlaunch operations is complete and sufficient.

2. In addition to the analysis provided in the FAA EA, this document EA provides an analysis of the lower and upper atmospheric air emissions from launch of the two USAF *ait* test vehicles.

3.2.1 LOWER ATMOSPHERE

For the purpose of this EA, the term “lower atmosphere” is used for the analysis of ground level emissions and emissions that occur within the troposphere, which extend from the ground surface to an altitude of approximately 15 km. This is the region of the atmosphere in which people are directly affected by air emissions.

3.2.2 UPPER ATMOSPHERE

For the purpose of this EA, the term “upper atmosphere” refers to the stratosphere, between the altitudes of approximately 15 km and 40 km. The actual extent of the stratosphere varies as a function of latitude and season. The stratosphere contains the Earth's ozone layer that protects the Earth's surface from harmful ultraviolet radiation. Most substances which deplete stratospheric ozone are regulated by the U.S. Environmental Protection Agency (USEPA) under the Clean Air Act. Hundreds of chemical reactions are involved in maintaining and depleting the Earth's stratospheric ozone layer. Some of these atmospheric reactions can be affected by the addition of certain chemicals from launches.

3.3 BIOLOGICAL RESOURCES

1. The FAA EA has been reviewed regarding existing biological resources of Kodiak Island and its environs in general, and the proposed KLC site in particular. The USAF adopts those portions of the FAA EA describing the existing environment regarding biological resources. However, this USAF EA includes a discussion of the Steller's eider (*Polysticta stelleri*), a sea bird, because the USFWS listed it as a threatened species after the release of the FAA EA. In addition, the USAF EA includes a discussion of the Steller sea lion because the NMFS reclassified it as an “endangered” species after the release of the FAA EA.

2. For a detailed description of the existing environment regarding other biological resources, the reader is referred to the FAA EA. In addition, Section 4.3 of this USAF EA analyzes the biological resources potentially present at the splashdown sites for the expended first and second stages of the USAF *ait* test vehicle, and the USAF *ait* instrumentation package.

3.3.1 STELLER'S EIDER

1. As discussed in the FAA EA, the strait between Narrow Cape and Ugak Island attracts marine birds on a year-round basis because of its shallow waters and abundance of food (i.e., fish and invertebrates) (Environmental and Natural Resource Institute [ENRI], 1995). Eiders and sea ducks common to the area include king eiders, Steller's eiders, harlequin ducks, oldsquaw, black scoters, surf scoters, and white-winged scoters. These species occur in large numbers from November to May. Steller's eiders, which breed during the summer in the area of Point Barrow, Alaska, are a common winter resident in the waters off Kodiak Island, with up to 600 individuals having been observed in the nearshore waters off Narrow Cape (ENRI, 1995).

2. On July 11, 1997, the USFWS determined the Alaska breeding population of the Steller's eider to be threatened pursuant to the Endangered Species Act of 1973, as amended. This determination was based upon a substantial decrease in the species' nesting range in Alaska, a reduction in the number of Steller's eiders nesting in Alaska, and the resulting increased vulnerability of the remaining breeding population to extirpation. Critical habitat for the Steller's eider has not been designated by the USFWS at this time (Federal Register, June 11, 1997; Vol. 62, No. 112). Section 7 of the Endangered Species Act requires consultation with the USFWS to assure that federal actions do not impact threatened or endangered species.

3.3.2 STELLER SEA LION AND OTHER MARINE MAMMALS

1. Based on public comments on the Draft EA, the following information is provided: As discussed in the FAA EA, three species of pinnipeds (i.e., Steller sea lion, harbor seal and Northern fur seal) are found in the waters near KLC. There are four major Steller sea lion rookeries (breeding grounds) on and near Kodiak Island and 17 haulout areas (ENRI, 1995). Three of these Steller sea lion haulout areas are within 15.5 miles of KLC (i.e., Chiniak Point, Ugak Island and Gull Point). Ugak Island is the closest haulout area and is approximately three miles southeast of KLC. Approximately 400 Steller sea lions use the Ugak Island haulout area (FAA EA, 1996).

2. Prior to June 1997, due to a declining population, the Steller sea lions were listed as threatened under the Endangered Species Act for their entire range, which extends from California to Alaska, and into the Bering Sea and North Pacific. Effective June 4, 1997, the NMFS reclassified that portion of the Steller sea lion population found west of longitude 144º West (a line near Cape Suckling, Alaska) as endangered pursuant to the Endangered Species Act (Federal Register, May 5, 1997; Vol. 62, No. 86). This reclassification includes the Steller sea lion population near Kodiak Island and KLC. The remaining U.S. population of Steller sea lions retain their listing as threatened. Section 7 of the Endangered Species Act requires consultation with the NMFS to assure federal actions do not impact threatened or endangered marine mammal species.

3. In addition, there are seven species of whales found in the waters near Kodiak Island. However, only humpback and gray whales use the waters near Narrow Cape and Ugak Island.

3.4 NOISE

1. The FAA EA has been reviewed regarding the existing noise environment of Kodiak Island and the proposed KLC site, the area potentially affected by the proposed processing and launch of the USAF *ait* test vehicles. The USAF adopts those portions of the FAA EA describing the existing environment regarding noise.

2. However, to address the specific noise impacts associated with the launch and reentry of the two USAF *ait* test vehicles, noise and sonic boom analyses have been conducted. The results of these analyses are discussed in Section 4.4.

3.5 HEALTH AND SAFETY

1. The FAA EA has been reviewed regarding public health and safety as it relates to the operation of facilities and launches from KLC. The USAF adopts those portions of the FAA EA describing the environment regarding health and safety, and adds a specific analysis of the potential health and safety issues directly related to the launch of the two USAF *ait* test vehicles from KLC. This section provides information regarding health and safety for the USAF *ait* program at KLC.

2. The reader is referred to the FAA EA for a detailed description of the existing environment regarding health and safety.

3.5.1 PUBLIC HEALTH AND SAFETY

1. Public health and safety issues related to the USAF *ait* program arise from activities involving preflight transport and storage of missile components, missile launch and missile flight. A major launch failure could potentially involve an explosion, missile debris, release of toxic materials into the air or water, high noise levels, and/or fire. Hazardous operations associated with the USAF *ait* program involve the use of explosives, flammable or toxic products and high-pressure gases.

2. The regulatory environment for health and safety issues consists of existing regulations and practices that have been established to minimize or eliminate potential risks to the general public from activities associated with the launch of a missile such as the USAF *ait* test vehicle. These regulations and practices include, but are not limited to, Department of

Transportation (DOT) regulations and USAF procedures for transporting hazardous materials, DoD procedures for handling explosives, and the DoD range safety program for the processing and launch of missiles, such as the USAF *ait* test vehicle.

3. DoD has an existing range safety program which is utilized to determine areas that will be evacuated for each mission. The objective of the program is to assure that the public is not exposed to unacceptable levels of risk. Range safety policies require areas that could be exposed to missile debris to be evacuated even though there is minimal risk to the public. The use of designated impact zones assures that the risk to the public is eliminated, physical security and safety measures can be enforced, and adverse environmental effects are minimized. The size of the evacuation area is determined based upon the potential for variability of the impact due to influences of local weather conditions, and small variances in the missile guidance and engineering systems.

4. The population of concern for the proposed action consists of persons in the general vicinity of the KLC site, U.S. Coast Guard personnel who periodically work at the Loran-C Station at Narrow Cape, and members of the public who utilize the site for recreation. In addition, other residents of eastern Kodiak Island, including Kodiak City and the U.S. Coast Guard Station, are included when considering public safety.

5. Other than individuals at the onsite Loran-C Coast Guard Station and at a private ranch, few members of the general public utilize the KLC site. In addition, the adjoining area is sparsely populated. Kodiak City and the U.S. Coast Guard Station, located approximately 30 to 40 miles from KLC, are the only sizable population centers on the island. The range safety program will assure that potential impacts will be well within the debris limit corridor (see Figure 4.5-1).

3.5.2 RANGE SAFETY

1. Although there is no existing test range associated with the proposed action, standard range safety operations for the USAF *ait* program will be applied in accordance with regulations established for Sea Test Ranges at the Naval Air Warfare Center Weapons Division (NAWC), Point Mugu, California (U.S. Navy, 1997). These procedures provide for flight safety, range clearance and surveillance, commercial air traffic control and ground

safety. Included in these procedures are published notice to pilots (i.e., notice to airmen) and notice to ships and boats (i.e., notice to mariners), and coordination with the FAA and U.S. Coast Guard.

2. The NAWC, on behalf of the USAF *ait* program, will assure that all aspects of safety are covered, including transport of hazardous materials (i.e., solid rocket motors), radio frequency (RF) interference, handling of the motors once they arrive at KLC, operations at the launch site and flight safety. The NAWC is responsible for assuring that the USAF *ait* test vehicle under any flight condition will not endanger any life or property. Because of the remote location of the launch site, NAWC will use two NP-3D Orion aircraft to provide monitoring and command destruct of the USAF *ait* test vehicle.

3. During launch preparation activities, ground safety at KLC will be the responsibility of NAWC, with assistance provided by USAF personnel. Hazardous operations will be performed in compliance with mission-specific operating procedures that will provide the requirements and direction for the activities at KLC, including explosives handling safety, hazardous operations control, explosives storage, launch pad operations and launch. Applicable safe operating procedures will be followed in conjunction with DoD Explosives Safety Standard 6055.9 and NAVSEA OP 5, Volume 1, *Technical Manual for Ammunition and Explosive Ashore, Safety Regulations for Handling, Storage, Production, Renovation and Shipping.*

4. During a launch, various contingency plans will be in effect to cover emergency situations. These include, but are not limited to:
   - Rocket Motor Mishap: There will be an Explosive Ordnance Disposal Plan in place with appropriate personnel and equipment.
   - Fire: There will be a firefighting crew in place during launch countdown.
   - Injury: An evacuation plan will be in place to transport injured persons by appropriate means as dictated by seriousness of injury.

3.6 HAZARDOUS MATERIALS AND WASTE

1. The FAA EA has been reviewed regarding hazardous materials that would be utilized and/or result from launch operations at KLC. The USAF adopts those portions of the FAA EA

describing the existing environment regarding hazardous materials and waste. However, this section provides information specific to characteristics of the USAF *ait* test vehicles.

2. For a detailed description of other hazardous materials that will be utilized at KLC, the reader is referred to the FAA EA.

3. The USAF *ait* test vehicle contains the following hazardous materials or fuels:
   - Ammonium Perchlorate
   - Nitroglycerin
   - 2-Nitrodiphenylamine (2-NDPA)
   - Nitrocellulose
   - Cyclotetramethylentetranitramine (HMX)
   - Resorcinol (1,3-Dihydroxybenzene)
   - Triacetin
   - Hydraulic Fluid

4. Except for the hydraulic fluid, the above substances are suspended in a binder matrix within the two solid rocket motors. The hydraulic fluid is enclosed in the vector control system and nozzle control system. Under nominal conditions, hazardous materials related to the USAF *ait* test vehicle do not present a potential impact.

5. Small amounts of potentially hazardous substances such as hydrogen chloride gas (HCl), solid alumina particles (Al_2O_3), carbon monoxide gas (CO) and nitrogen oxide gas (NO) would be generated from combustion of the solid rocket propellant during launch or in the event of a launch failure or a launch abort.

CHAPTER 4.0
ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 GEOLOGY AND SOILS, WATER, LAND USE, SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, RECREATION, VISUAL AND CULTURAL RESOURCES

The FAA EA has been reviewed regarding potential impacts to the geology and soils, water, land use, socioeconomics, environmental justice, recreation, visual and cultural resources of Kodiak Island and the proposed KLC site, the area potentially affected by the proposed processing and launch of the USAF *ait* test vehicle. The USAF adopts the analysis and conclusions of the FAA EA with regard to geology and soils, water, land use, socioeconomics, environmental justice, visual and cultural resources. Therefore, no further discussion with regard to these matters is provided. The FAA EA is included as Attachment 1 to this USAF EA.

4.2 AIR QUALITY

4.2.1 PROPOSED ACTION

The FAA EA has been reviewed regarding potential impacts to air quality from the construction and operation of KLC. The USAF adopts the analysis and conclusions of impacts to air quality in the FAA EA with regard to pre/postlaunch operations in general. The USAF determined that a specific analysis of air quality impacts related to the launch of the two USAF *ait* test vehicles would be included in this USAF EA. The results of that analysis are discussed below. A detailed air quality analysis for the launch of the two USAF *ait* test vehicles is included in Appendix B.

4.2.1.1 Lower Atmosphere *ait* Emissions

1. The USAF *ait* sub-orbital test vehicle will not require the use of Class I or Class II ozone depleting substances (ODS) in the operation or maintenance of the USAF *ait* systems, subsystems, components or processes. Therefore, no ground-level ODS will be emitted as a result of processing the USAF *ait* test vehicle at KLC. Since prelaunch processing of the two USAF *ait* test vehicles will be minimal, ground-level activities involving substances other than ODS also are not expected to impact air quality.

2. Within the lower atmospheric region, ground-level air emissions from launch of the USAF *ait* test vehicle are the primary consideration. Computer model calculations have been

performed to estimate air emissions from both normal launches and ground-level catastrophic aborts of the USAF *ait* test vehicle at KLC. A description of the Rocket Exhaust and Effluent Diffusion Model (REEDM),Version 7.07 used for these calculations is provided in Appendix B.

3. To model and calculate the ground-level emissions, two meteorological cases were analyzed to correspond to the proposed launches of the USAF *ait* test vehicle from KLC in the time period from July through September 1998 and March 1999. Normal temperatures and wind speeds for the months of March and July were obtained from National Oceanic and Atmospheric Administration (NOAA) data available for Kodiak. Onsite year-round records are not available for Narrow Cape.

4. On Kodiak, wind direction is independent of the time of year, with the main seasonal variations being temperature and wind speed. The average wind speeds used in the REEDM analysis for the USAF *ait* program are 5.55 meters per second (m/s) in March and 3.45 m/s in July. These values are close to the yearly average of 4.9 m/s from a prevailing northwest direction. The calculations would not change significantly if a different launch month was selected. The dispersion model is not highly sensitive to temperature, but typical temperatures of 12.4 Celsius (C) for July and 0.5 C for March were used for the USAF *ait* analyses. The wind conditions most likely to produce adverse air quality impacts, which are nearly calm winds out of the west, were also analyzed. These conditions occur 2 percent of the time throughout the year (FAA, 1996). No meteorological constraints on launching due to vehicle emissions have been identified for the USAF *ait* flights from KLC.

5. Pollutant concentrations versus distance downwind were calculated for a normal USAF *ait* launch and for an aborted launch for the two launch periods and for typical and calm wind conditions. The resultant peak pollutant concentrations versus distance downwind are shown in Appendix B, Figures 1 through 8. For a normal launch case, five pollutants are predicted; Al_2O_3, HCl, CO, NO and Cl_2. For the abort case, only three pollutants are tracked since the model does not predict the formation of NO or Cl_2. Because KLC is near the ocean, a significant fraction of the gas phase HCl will condense in the marine aerosol. This will lower the gas phase concentrations, but will also retard ground deposition and will reevaporate in several minutes, leaving downwind concentrations unchanged (Brady, 1997).

6. For normal launches, the four wind/month conditions result in similar maximum concentrations of the five pollutants. The concentrations for gas phase pollutants are less

than 0.5 parts per million (ppm) for locations downwind; none but HCl exceeds 0.05 ppm. Figures 1 through 4 in Appendix B show where the peak concentrations of each pollutant occur for each of the nominal launch conditions. As the wind speed increases, the peak is reduced and occurs a greater distance from the launch site.

7. Figures 5 through 8 of Appendix B show that, for the USAF *ait* launch abort cases, the three pollutant concentrations downwind are expected to be lower than for normal launches. This is because solid propellant burns more slowly in the open than in a rocket motor, and because the explosion is expected to scatter chunks of solid propellant over a wider area. The downwind range of peak concentrations is larger for the abort cases; this is consistent with the scattering of solid-rocket propellant in an explosion. The peak concentrations are lower for the calm wind cases in the abort scenario. Season does not affect peak concentrations.

8. The one-hour average exposure for a person coincidentally situated at the location of peak concentration downwind from an USAF *ait* launch is less than 0.025 ppm (see Figure 9, Appendix B) for the conditions analyzed. The Occupational Health and Safety Administration (OHSA) personnel exposure limit for HCl is 5 ppm on an eight-hour basis. The USAF Space Command Surgeon's Office recommends an instantaneous maximum HCl exposure of no greater than 10 ppm to sensitive human populations on or near Vandenberg AFB and Cape Canaveral Air Station. That level of exposure would pose some risk to the average individual but would not cause permanent health effects. For exposures above 10 ppm, persons should seek shelter or remove themselves from the area. Discomfort may also be felt at a 2 ppm one-hour average, or at instantaneous exposure of 10 ppm, but no hazard to healthy individuals occurs at that level. The HCl concentrations of 0.025 ppm resulting from the USAF *ait* launches fall far below these levels.

9. The concentrations of Al_2O_3 downwind from an USAF *ait* launch or abort are given in milligrams per cubic meter (mg/m^3) in Figures 1 through 9 of Appendix B. The USAF has not established exposure standards for alumina particles. However, the concentrations of $A1_2O_3$ may be used for cumulative air quality considerations of particulate matter (aerodiameter less than 10 microns [PM_{10}]). Figures 1 through 8 of Appendix B show that Al_2O_3 concentrations are expected to be less than 2 mg/m^3, while 60-minute maximum exposures would be less than 0.25 mg/m^3.

10. Because the FAA EA for KLC indicated that the highest concentrations of launch emissions were found on an uninhabited mountain 5 km east of the launch site, that location was evaluated for each USAF *ait* scenario discussed above. In the prevailing wind cases, concentrations at the mountain site are zero except for Al_2O_3. For the calm wind cases, the Al_2O_3 concentration is approximately 30 percent smaller than the peak concentrations; the other chemical species are a factor of 5 to 10 smaller than their respective peak concentrations.

11. The difference between the results presented in the FAA EA and those in this USAF EA are due to the fact that the mountain site is located inland from the launch pad, whereas many of the peak concentrations shown in Figures 1 through 8 in Appendix B, especially in the prevailing wind cases, will occur over the open ocean.

12. In conclusion, HCl is the main gas phase pollutant released during the USAF *ait* launch events. Its peak concentrations will be below 0.5 ppm, while the 60-minute mean concentrations will be below 0.025 ppm. The peak levels are expected to occur at unpopulated locations downwind of the launch site. In addition, the levels would not be harmful to individuals should exposure occur. As addressed in the FAA EA, these levels would not result in significant impacts to plants or animals from the two USAF *ait* test vehicle launches. Other gas phase pollutant concentrations will be an order of magnitude smaller.

4.2.1.2 Upper Atmosphere *ait* Emissions

1. The first and second stage solid rocket motors of the USAF *ait* test vehicle produce exhaust emissions containing chlorine compounds. The primary chlorine compound produced at the nozzles of each of the two stages is HCl. Through high temperature afterburning reactions in the exhaust plume, the HCl is partially converted to atomic chlorine and molecular chlorine (Cl and Cl_2) (Burke and Zittel, 1997; Zittel, 1994). These more active forms of chlorine can contribute to localized ozone depletion in the wake of the launch vehicle, and also to the overall global chlorine loading which contributes to long-term ozone depletion. The HCl remains in the stratosphere for about three years, and then diffuses down to the troposphere. Details of the computer models used to generate the emission quantities are provided in Appendix B.

2. The USAF *ait* test vehicle will spend approximately 25 seconds in the stratosphere between 15 and 40 km. The first stage of the USAF *ait* test vehicle will deposit approximately 400 pounds (lbs) of HCl and approximately 550 lbs of combined Cl and Cl_2 between 15 km and 34.6 km (burn-out). This represents less than 30 lbs of active chlorine being distributed per km of altitude by the first stage. The second stage, which ignites at an altitude of 34.6 km, will contribute a total of approximately 6 lbs of HCl, Cl and Cl_2 between ignition and 40 km altitude. It is estimated that less than 1 lb per km of altitude of the active forms of chlorine would be emitted by the second stage. Due to the large air volume over which these emissions would be spread, and because of rapid dispersion by stratospheric winds, the active chlorine from the two USAF *ait* test vehicle launches would not contribute to localized ozone depletion. Since the two proposed USAF *ait* launches are spaced eight months apart, there is no local cumulative effect in the stratosphere from chlorine compounds generated by the USAF *ait* launches. On a global scale, a total of 1,912 lbs of chlorine will be added to the stratosphere from both launches. This amount is a very small fraction of chlorine compared to other solid rockets in use.

3. Two other types of substances, Al_2O_3 and nitrogen oxide (NO_x) species, are also of concern with respect to stratospheric ozone depletion. The Al_2O_3, which is emitted as solid particles, has been the subject of study with respect to ozone depletion via reactions on solid surfaces. The studies (Molina, 1996) indicate that Al_2O_3 can activate chlorine. The exact magnitude of ozone depletion that can result from a build-up of Al_2O_3 over time has not yet been determined quantitatively, but will be insignificant bases on existing analysis.

4. Exhaust from the first stage of the USAF *ait* vehicle is approximately 27 percent by weight Al_2O_3, and the second stage exhaust is 35.4 percent Al_2O_3 by weight. The total amount of Al_2O_3 deposited between 15 and 40 km by each USAF *ait* flight is approximately 1,180 lbs from the first stage and 83 lbs from the second stage. The Al_2O_3 is in the form of smooth particles with sizes varying in diameter from less than 1 micron to 10 microns (Beiting, 1997). Depending on the altitude of injection, the particles diffuse out of the stratosphere in time periods varying from weeks to a few years. The particles will participate in reactions which may cause ozone depletion (Molina 1996) during the limited time they stay in the stratosphere (Jackman, 1996). The Al_2O_3 solid particles would add to the overall atmospheric burden of particles until they eventually migrate downward to the ground, but because of the large volume of the stratosphere and rapid horizontal mixing, they would not significant cause localized effects on stratospheric ozone. On a regional or global scale, the

chlorine and alumina will add to the total chemicals in the stratosphere, but the amount is so small that it is difficult to assign statistical significance to their effects on the ozone layer.

5. Nitrogen oxide, like certain chlorine-containing compounds, contributes to catalytic gas phase ozone depletion. The production of NO_x species from solid rocket motors is dominated by high temperature reactions known as "afterburning" in the exhaust plume. As the temperature of the exhaust decreases with increasing altitude, less NO_x is formed. In the USAF *ait* case, the first stage afterburning production of NO_x is nearly shut down before the vehicle reaches the stratosphere. The total NO_x deposited in the stratosphere is approximately 4 lbs from the USAF *ait* first stage and less than 1 lb from the second stage. Diffusion and winds would disperse these quantities rapidly, therefore, no significant effect on ozone levels is expected from these emissions.

6. In summary, HC1, $A1_2O_3$ and NO_x emissions from USAF *ait* test vehicle launches into the stratosphere would be insignificant because of the rapid dispersion predicted for such small quantities of substances. The small quantity of these compounds from the USAF *ait* program would not have a significant impact on stratospheric ozone.

4.2.2 CUMULATIVE IMPACTS

Due to the wind dispersion at Narrow Cape and the eventual gravitational settling of Al_2O_3, there would not be significant cumulative impacts to air resources associated with the two launches of the USAF *ait* test vehicle. Cumulative impacts to the upper atmosphere would be minimal in comparison to the impacts caused by other launch vehicles. Based on public comments on the Draft EA, the following information is provided: The expected emissions from worldwide space launches annually during the years 1998 to 2010 is 2,161 tons of alumina particles and 1,468 tons of inorganic chlorine (Brady, 1994). As noted in Section 4.2.1.2 of the USAF EA, the two USAF *ait* launches proposed to occur eight months apart, will release 1.26 tons of alumina particles (Al_2O_3) and 0.956 tons of inorganic chlorine into the stratosphere. This equates to an annual contribution to worldwide space launches of 0.058 percent for alumina particles and 0.065 percent for inorganic chlorine should both the USAF *ait* vehicles be launched in the same year. Furthermore, worldwide space launches represent 0.25 percent of the total inorganic chlorine produced in the stratosphere (Brady, 1994). These small amounts of emissions would not significantly contribute to a cumulative impact to stratospheric ozone. Section 4.1.3 of the FAA EA provides additional information on the negligible cumulative impact of launches from KLC.

4.2.3 NO ACTION ALTERNATIVE

If the No Action alternative is selected, the USAF *ait* program would not take place at Kodiak Island. The potential impacts cited above would not occur as related to the proposed USAF *ait* program.

4.3 BIOLOGICAL RESOURCES

1. The FAA EA has been reviewed regarding potential impacts to the biological resources of Kodiak Island and environs in general, and the proposed KLC site in particular, the areas of concern relative to the proposed USAF *ait* test vehicle. The USAF adopts the analysis and conclusions of the FAA EA with regard to the potential impacts to biological resources from site operations and vehicle launches, including the two proposed USAF *ait* launches. However, the recent listing of the Steller's eider and location of the USAF *ait* vehicle launch trajectory near Ugak Island where Steller sea lions, now listed as endangered species, haul out necessitate additional discussions. In accordance with Section 7 of the Endangered Species Act, the USAF has consulted with the USFWS on the Steller's eider and NMFS for the Steller sea lion to assure that the proposed USAF action is not likely to jeopardize the continued existence of the species or result in destruction or modification of the species habitat.

2. For a detailed description of potential impacts to other biological resources, the reader is referred to the FAA EA.

4.3.1 PROPOSED ACTION

4.3.1.1 <u>Steller's Eider</u>

1. The Steller's eider, a seabird commonly found in this area during the winter, was recently listed as a federal threatened species. In accordance with the Endangered Species Act, the USAF has completed informal Section 7 consultation with the USFWS for the first USAF *ait* launch. In a letter dated October 28, 1997, the USFWS concurred with the USAF conclusion that the first proposed USAF *ait* launch is not likely to adversely affect threatened or endangered species, and stated that further consultation under Section 7 of the Endangered Species Act is not required at this time. USFWS's concurrence is based upon a proposed first launch date no earlier than July 1998, and upon an USFWS-approved fully funded, statistically valid USAF surrogate seabird monitoring plan being in place prior to the first USAF *ait* launch. The specific monitoring requirements are set forth in the October 28,

1997, USFWS letter in Appendix D of the EA. Consultation pursuant to Section 7 of the Endangered Species Act will commence for the second launch (currently proposed for March 1999) within 30 days of the first launch, and will be based, in part, on the results of the monitoring efforts associated with the first launch. If the first launch is delayed past September 15, 1998, or if project plans change, additional information on listed or proposed species become available or new species are listed that may be affected by the project, the USAF will reinitiate consultation with the USFWS regarding the first USAF *ait* launch. Without the completion of the required additional consultation with, and approval by, the USFWS, the USAF will not conduct the first launch between September 15, 1998 and April 1999 to avoid the first launch occurring while the threatened Steller's eiders are present. The second launch will be conducted in accordance with the USFWS consultations regarding results of the monitoring that occurred prior to, during and after the first launch so as to avoid adversely affecting threatened or endangered species.

2. Based on discussions with the USFWS, there is concern for potential impacts to Steller's eiders from onsite lighting at KLC. This concern is based on reports of strikes by Steller's eiders and other sea birds on unshielded lights of fishing vessels and at an airport radar facility during periods of "low weather" and fog. Bird strikes during stormy weather are also common to crabbing vessels in the Bering Sea (Balogh, 1997). Lighting at KLC will consist of low-level safety and security lighting on the exteriors of facilities at the site. Such lighting is typically downcast and shielded. Processing of the USAF *ait* test vehicle prior to launch will occur within an enclosed facility and therefore will not require exterior lighting. It is important to note that KLC facilities are sited some distance from the ocean. The nearest structure is the water pumphouse, about 600 meters (2,000 feet) from shore, while the Launch Pad is about 1,050 meters (3,500 feet) and the Launch Control and Management Center is about 1,800 meters (6,000 feet) from shore. Also, there is intervening topography and vegetation between KLC facilities and the shore. As a result of these factors, onsite lighting is not expected to attract seabirds, including the Steller's eider. Potential impacts related to onsite lighting are not expected to be significant.

3. In the event of a major launch failure during approximately the first minute of flight of an USAF *ait* test vehicle, debris could fall in the ocean off Narrow Cape. The debris would not fall in a concentrated pattern and the chance of hitting even a single sea bird sitting on the ocean surface is remote. However, the chance of a launch failure during the first minute of

launch is also remote. Therefore, it is anticipated that Steller's eiders would not be significantly impacted in the unlikely event of catastrophic failure and subsequent debris scatter of the USAF *ait* test vehicle over the Narrow Cape area.

4.3.1.2 Steller Sea Lion and Other Marine Mammals

1. Potential impacts to the Steller sea lion (*Eumetopias jubatus*) would be related to the launch trajectory of the USAF *ait* test vehicle, which will fly near Ugak Island immediately after lift-off (see Figure 4.5-1). It is estimated that approximately 300 to 400 Steller sea lions utilize Ugak Island as a haulout, but not a rookery, during the late summer and early fall postbreeding period (FAA EA, 1996; ENRI, 1997) (see Figure 4.4-1).

2. Based upon public comment to the Draft USAF EA, the following information is provided: In a letter dated October 24, 1997, and in subsequent conversations, the NMFS concurred with the USAF's opinion that predicted launch and overflight noise will not have significant effects on marine mammals. The maximum predicted noise levels at Ugak Island from the launch of the USAF *ait* vehicle are between 85 and 90 A-weighted decibels (dBA) (see Figure 4.4-2). The NMFS advises that, based on its experience at Vandenberg AFB, launch noise levels must exceed 100 dBA to produce significant impacts to similar species. However, because the USAF assessments are based on predicted rather than measured noise levels, NMFS has requested and the USAF has agreed to perform NMFS approved monitoring of Steller sea lion haulouts before, during and after the first USAF *ait* launch. This monitoring will be similar to that described above with regard to the Steller's eider. As with the Steller's eider, the second launch will be conducted in accordance with consultation with NMFS regarding the monitoring results from the first launch so as to avoid adversely affecting threatened or endangered marine mammals. In addition, the USAF will not conduct either USAF *ait* launch during the peak gray whale migrating periods of April through May and November through December without prior consultation with, and approval by NMFS.

3. As shown in Figure 4.5-1, the trajectory for the USAF *ait* test vehicle is approximately one mile from Ugak Island. As a result, the debris scatter from a potential major failure of the USAF *ait* test vehicle would not impact Ugak Island. Therefore, a major failure of the launch of the USAF *ait* test vehicle would not impact Steller sea lions or harbor seals hauled-out on Ugak Island.

4. Based upon public comment to the Draft USAF EA the following information is provided: The USAF recognizes that whales are protected species. Section 4.5.2.3 of the FAA EA specifically analyzed and addressed the potential impacts from launch operations from KLC to marine mammals. The USAF adopts this FAA EA analysis and findings (see USAF EA section 1.3 para 2 and section 4.3). This included an analysis of the seven whale species found in the waters near Kodiak Island. In its analysis, the FAA EA indicated that of the seven whale species, only the humpback whale and the gray whale use the nearshore waters of Narrow Cape and Ugak Island.

   The FAA EA determined that, due to the following, humpback and gray whales are not expected to be affected by launch operations from the KLC:

   - Relatively small number of launches planned per year.
   - Whales are found in the Narrow Cape area during only part of the year with the peak migratory periods occurring in April through May and November through December.
   - Calving and breeding would not be disrupted.
   - Expected attenuation of launch noise at the air-water interface.

5. During the flight of the USAF *ait* test vehicle, the expended first and second stage of the vehicle and the instrumentation package would impact in the Pacific Ocean. The expended first stage would impact in the ocean approximately 300 km downrange, and the expended second stage and instrumentation package would impact the ocean approximately 1,800 km downrange and approximately 300 km off the coast of southern Washington state. Depending on the season, these areas could be used by marine mammals, including migratory whales and pelagic species. The chance of an expended stage or the instrumentation package hitting a marine mammal on the surface or near the surface of the ocean is remote. Therefore, it is anticipated that marine mammals, including migratory whales and pelagic species, in the open ocean would not be significantly impacted by the expended USAF *ait* stages or instrumentation package as the splashdown in the water.

6. In the event of a major launch failure during the flight of an USAF *ait* test vehicle, debris would fall in the ocean. Depending on the time of the failure, some debris could potentially fall in areas of the Pacific Ocean used by marine mammals, including migratory whales and pelagic species. The debris would not fall in a concentrated pattern. Based on public comments on the Draft EA the following information is provided: As an example, if the

booster were to fail 30 seconds into flight, the debris pattern is expected to land in an oval pattern, no closer than one mile northeast of Ugak Island. The debris pattern is predicted to be made up of 113 pieces of the detonated first stage, most of which will be in the 50 to 200 pound range, plus the second stage and payload which will remain intact. The debris oval for this example is predicted to be approximately 1 mile long by ½ mile wide comprising an area of 335 acres. This results in a debris density of about one piece per three acres of open ocean. In addition, the chance a marine mammal would be near the surface in the debris area is limited. Therefore, it is anticipated that marine mammals, including migratory whales and pelagic species, would not be significantly impacted in the event of a major launch failure and resulting debris scatter of an USAF *ait* test vehicle.

4.3.1.3 Noise and Sonic Boom

1. Noise impacts associated with launch of the USAF *ait* test vehicle are addressed on a comprehensive basis in Section 4.4. Specific to Steller sea lions and harbor seals that utilize Ugak Island, noise from the USAF *ait* would not be significant. Launch noise from the USAF *ait* test vehicle will be approximately 85 dBA at Ugak Island. This noise would be of low frequency, short duration and likely near ambient levels, depending on wind and surf conditions. As a result, the impact to Steller sea lions and harbor seals hauled out on Ugak Island is not expected to be significant (Stewart, 1997).

2. As discussed in Section 4.4, a focused sonic boom is expected to occur during the ascent phase of the USAF *ait* test vehicle. Responses to a sonic boom depend on the intensity of the boom and biological chronology of the affected species (Stewart, 1997). The maximum focused boom at the surface from the USAF *ait* launch would be 2.7 psf (equivalent to 136 dB), a relatively low amplitude, about 40 nautical miles downrange from the launch pad and more than 35 miles from Ugak Island (see Figure 4.4-3). As a result, the ascent phase sonic boom from the USAF *ait* test vehicle would not be heard at Ugak Island and would not have the potential to impact marine mammals on Ugak Island.

3. The focused sonic boom from the ascent phase of the USAF *ait* test vehicle will occur in an area of the Pacific Ocean used by marine mammals, including migratory whales and pelagic species. The chance of a marine mammal being on or near the surface of the ocean in the limited area affected by the focused sonic boom is remote. However, in the event a marine mammal is on the surface in the area, the impact would not be significant due to the relatively low amplitude of the sonic boom (Stewart, 1997).

4. The underwater pressure of the focus sonic boom from the USAF *ait* ascent phase is expected to impact a water column ranging to a depth of about 100 meters and have an estimated pressure range of 0.01 pounds per square foot (psf) (equivalent to 120 decibels [dB]) to 2.0 psf (equivalent to 160 dB). It is known that, with marine mammals, a noise of 120 dB may result in behavioral effects and noise of 160 dB may cause some harm (Stewart, 1997). However, based on the short duration of this sonic boom (200 milliseconds [Cheng, 1997]) and on the limited impact area, these impacts are not expected to be significant.

5. As discussed in Section 4.4, a carpet boom with a maximum amplitude of 3.2 psf (equivalent to 138 dB) is expected to occur about 1,300 nautical miles downrange from the launch pad, during the descent phase of the USAF *ait* test vehicle (Figure 4.4-3). The descent phase sonic boom would not affect species on Ugak Island. As discussed above for the ascent phase focused sonic boom, the chance of a marine mammal being on or near the surface of the ocean in the limited area of the descent phase sonic boom is remote. However, in the event a marine mammal is on the surface in the area, the impact would not be significant due to the relatively low amplitude of the sonic boom (Stewart, 1997).

6. While little is known of the potential effects of exposure to impulse noise on marine mammals below the sea surface, the small USAF *ait* test vehicle would produce relatively small overpressures of the ascent and descent booms. As a result, any responses from marine mammals within a few tens of meters below the surface would likely be limited to minor behavioral changes. The locations and relatively small impact areas of the sonic booms would likely affect only a few individuals of marine mammals, and impacts would not be significant (Stewart, 1997).

7. The area of impact for the two focused booms and two carpet booms is relatively small. As a result, given the relatively small number of marine mammals, including migrating whales and pelagic species, that might be near the surface within either of the boom-impact zones at the time of impact, significant impacts are not expected.

4.3.2 CUMULATIVE IMPACTS

Cumulative impacts as a result of launching the two USAF *ait* test vehicles would be insignificant as compared with other past, present, or reasonable foreseeable future actions

at the KLC. Potential impacts from a single launch are not expected to be significant. Due to the eight months between the two USAF *ait* launches, cumulative impacts also would not be significant.

4.3.3 NO ACTION ALTERNATIVE

Under the No Action alternative the proposed two launches of the USAF *ait* test vehicle would not occur. Therefore, potential impacts to biological resources also would not occur.

4.4 NOISE

1. The FAA EA has been reviewed regarding noise impacts of construction and operation of the KLC site, the area potentially affected by the proposed processing and launch of the USAF *ait* test vehicle. The USAF adopts the analysis and conclusions in the FAA EA with regard to pre/postlaunch operations. Additionally, the USAF determined that a specific analysis of noise impacts related to launch of the USAF *ait* test vehicle is appropriate for this USAF EA.

2. To address launch specific noise and sonic boom impacts associated with the USAF *ait* program, additional analyses were conducted, and the results are discussed below. The detailed noise analyses completed for the USAF *ait* program are included in Appendix C.

4.4.1 PROPOSED ACTION

4.4.1.1 <u>Launch Related Noise Impacts</u>

4.4.1.1.1 On-Pad Rocket Noise

1. On-pad rocket noise occurs when the vehicle engines are firing. While the noise levels from a launch are highest at the launch pad, on-pad noise levels away from the launch pad itself are typically much lower than in-flight noise levels because the sound source is low, and the sound waves move along the ground and tend to experience significant attenuation over long distances.

2. On-pad rocket noise levels for the launch of the USAF *ait* test vehicles are shown in Figure 4.4-1. As shown in Figure 4.4-1, noise levels for the USAF *ait* test vehicles are 95 dBA approximately 6,250 feet from the center of the pad, decreasing to 70 dBA at a distance of 5.6 to 15 miles from the launch pad. For a perspective on these noise levels,

Table 4.4-1 shows that 95 dBA is comparable to noise generated by a DC-9 aircraft as heard from a distance of 6,000 feet, and 70 dBA is comparable to the noise level from a heavy truck at a distance of 50 feet. Noise generated by the launch of the two USAF *ait* test vehicles will be present for approximately one minute. Noise from the launch of the two USAF *ait* test vehicles will not be significant due to the short duration of the noise event and low frequency of noise generated.

4.4.1.1.2 In-Flight Rocket Noise

1. In-flight rocket noise occurs when the vehicle is clear of the launch pad, and sound propagates from the vehicle to the ground without significant attenuation. The major sources of rocket noise are from interaction of the exhaust jet with the atmosphere, noise from the combustion chamber, and noise from the postburning of fuel-rich combustion products in the atmosphere. The emitted acoustic power from a rocket engine and the frequency spectrum of the noise can be calculated from the number, size and thrust, and flow characteristics of the engines. To evaluate the potential noise impact associated with launch and ascent, it is necessary to consider not only the overall sound level, but the frequency spectrum and duration of exposure.

2. Launch noise and ascent noise for the USAF *ait* test vehicle were computed using the RNOISE model recently developed for launch vehicle analysis (see Appendix C.1). Figure 4.4-2 shows the maximum noise level contours in the near field for the USAF *ait* test vehicle during flight. The maximum in-flight noise level (see Figure 4.4-2) is generally higher than the launch pad noise level, as shown in Figure 4.4-1. This is a direct result of the sound source (i.e., the vehicle) being aloft.

3. As shown in Figure 4.4-2, in-flight noise levels for the USAF *ait* test vehicle range from 90 dBA at a distance of approximately 9,000 feet from the launch pad, to 70 dBA at a distance of between 8.7 to 12.3 miles from the launch pad. Noise levels from launch of the USAF *ait* test vehicle will not be significant due to the noise levels generated and the short duration of time that they are present.

4.4.1.1.3 Sonic Boom

1. Sonic boom from launches occurs when the vehicle is at supersonic speeds and has pitched over sufficiently for the boom to propagate to the ground. The generation of ascent related

sonic boom from the USAF *ait* depends on vehicle geometry and the rocket exhaust plume size and drag. For the USAF sub-orbital *ait* test vehicle, there will also be a sonic boom during the descent phase the USAF *ait* instrument package. Descent related sonic boom depends on the geometry of the reentry of the instrument package.

2. Sonic booms for the launch of the USAF *ait* test vehicle were computed using the PCBoom3 model (see Appendix C.1). Figure 4.4-3 shows the sonic boom footprints for the USAF *ait* sub-orbital test flights. There are two distinct footprints: a crescent shaped focal zone about 75 km (46 miles) south of the launch point associated with the ascent phase of the USAF *ait* test flight; and a concentrated carpet boom region at the splashdown point of the USAF *ait* instrument package approximately 1,800 km (approximately 1,130 miles) from the launch site and 300 km off the coast of southern Washington state. Both of these footprints occur over open ocean.

3. The ascent phase of the USAF *ait* test flight focal zone footprint has the characteristics of an ascent accelerated boom: a small, high amplitude focal zone at the leading edge, followed by a lower amplitude carpet boom. The maximum ascent phase focus boom amplitude at the water surface for the USAF *ait* test vehicle is 2.7 psf (see Appendix C.1). The trailing carpet boom from the ascent phase diminishes rapidly as the vehicle gains altitude.

4. The USAF *ait* descent phase carpet boom footprint surrounds the splashdown point of the instrumentation package. This type of footprint would be circular for a pure vertical descent. Because the USAF *ait* descent is at an angle, the footprint is distorted somewhat in the uptrack direction. The maximum sonic boom, generated when the vehicle is at an altitude of approximately 2,400 meters (approximately 7,875 feet) when the USAF *ait* instrumentation package is about to become subsonic, is about 3.2 psf at the water surface (see Appendix C.1).

5. The USAF *ait* test vehicle will generate focused sonic booms ranging from 2.7 psf to 3.2 psf at the water surface. This is comparable to military fighter aircraft which generate focused sonic booms up to 3.0 psf, with occasional focused booms that range from 5 to 10 psf. Therefore, the focused sonic booms from the USAF *ait* test vehicle are similar to those generated by fighter aircraft (Plotkin, 1997).

6. As shown in Figure 4.4-3, both USAF *ait* sonic boom footprints (e.g., ascent and descent) are over water. The ascent sonic boom, with an overpressure of 2.7 psf, generates an

underwater noise level of approximately 160 dBA for 200 milliseconds which can travel to a depth of 100 meters below the ocean surface. This noise will attenuate to approximately 10 percent of its original 160 dBA at 100 meters and will be spread over a limited area (see Appendix C.2). The descent sonic boom generates an overpressure of 3.2 psf at the water surface for 200 milliseconds. It will affect an extremely small column of ocean, as the sound distribution across the boom pattern on the surface of the ocean will be concentrated in the center. Therefore, the impact will not be significant.

7. Based on the above, the USAF has concluded that, due to the extremely short duration of time in which both sonic booms take place, and the minimal areas they affect, the sonic booms generated by the two USAF *ait* test vehicles would not result in a significant impact.

4.4.2 CUMULATIVE IMPACTS

Two launches of the USAF *ait* test vehicle are proposed. These launches are scheduled eight months apart (July 1998 and March 1999), so they are effectively isolated events. The single event noise impacts discussed above represent the total impact. Therefore, since each launch presents no significant impact, the sum of both launches would not result in a significant cumulative impact as compared with other past, present, or reasonable foreseeable future actions at the KLC.

4.4.3 NO ACTION ALTERNATIVE

Under the No Action alternative, the USAF *ait* program would not occur. While the noise levels and sonic boom overpressures from the USAF *ait* program are not significant, these impacts would not occur under the No Action alternative.

4.5 HEALTH AND SAFETY

4.5.1 PROPOSED ACTION

4.5.1.1 Public Health and Safety

1. Missile components and support equipment for the USAF *ait* program will be transported by military aircraft to the Kodiak Airport and then on over-the-road trucks from the Kodiak Airport to KLC, where they will be placed in the Integration and Processing Facility until needed. The transport and handling of hazardous materials will be conducted in accordance with applicable DoD procedures and in accordance with applicable DoD explosives safety

standards. Explosive safety quantity distance will be established in accordance with applicable directives and maintained around facilities where the missile components are stored and handled (Navy Air Warfare Weapons Division, 1997). Applicable regulations include, but are not limited to, the following:

- Aircraft Transport:
  - Mil-Std-1971 - Designing for Internal Aerial Delivery in a Fixed Wing Aircraft.
  - AFJM 24-204 - Preparing Hazardous Materials for Military Air Shipments.
- Roadway Transport:
  - Mil-Std-1366C - Transporting Criteria.
  - Mil-Std-1784 - Mobility Towed and Manually Propelled Support Equipment.
  - CFR Title 49, Part 213 - Code of Federal Regulations Packaging and Transportation of Hazardous Materials, Truck Safety Standards.
- Hazardous Materials and Explosives:
  - NAVSEA OP 5, Volume 1, technical Manual for Ammunition and Explosive Ashore, Safety Regulation for Handling, Storage, Production, Renovation and Shipping
  - AFM 91-201 - Air Force Explosive Safety Standards.
  - AFTO 11A-1-47 - DoD Explosive Hazard Classification Procedures.
  - DoD 4145.26-M - DoD Contractors Safety Manual for Ammunition and Explosives.
  - DoD 6055.9 - DoD Ammunition and Explosives Safety Standards.

2. The USAF *ait* rocket motors will be transported in a rocket motor semitrailer designed to protect them from damage in the event of an accident. Because the fuel and explosives are sensitive to heat, there is the potential for ignition of propellant in an accident. However, as these boosters are solid propellant, they are much more stable than liquids or hypergolic fuels. DoD has considerable experience with shipment of missiles and other sensitive components. Analysis of past experience has shown the following potential for an accident involving the transport vehicle:

- Air Transport: In 1987, the USAF reported that the accident rate for military cargo aircraft was 1×10^{-3} for every 1,000,000 aircraft miles flown. Based on this, there is a one in 1 million probability of accident for every 1,000 miles of missile air transport.

- Road Transport: Representative data from the National Highway Transportation Safety Administration show a major accident rate of 6×10^{-8} per truck mile, or a probability of one accident in 16,000 trips of 1,000 miles each (U.S. Army, 1995).

3. Based on public comments on the Draft EA, the following information is provided: The rocket motors used for USAF *ait* are inherently safe. It would take an extraordinary event to cause an accidental detonation. USAF *ait* plans involving U.S. Coast Guard personnel or facilities will be submitted to the U.S. Coast Guard for coordination prior to implementation. Included among these plans is the emergency response plan, Recovery Guide for Rocket System Launch Program Motor Transportation Mishaps, dated June 1993, addressing potential mishaps during the actual transportation of the motors.

4. Based on public comments on the Draft EA, the following information is provided: Only a small fraction of accidents involving a transport vehicle would potentially affect a missile system being transported, as specialized shipping containers are used to protect the shipment. The USAF *ait* motors will be contained in specially designed trailers during transit to KLC. These trailers are designed for the transportation of Minuteman rocket motors and meet all legal guidelines required during transportation. The trailer has an environmental control system which maintains the temperature inside the trailer. It was designed for use with commercial tractors and has been used for over the road shipment of Minuteman rocket motors for over 30 years. The USAF *ait* motors will not have to leave the trailer during shipment to KLC. A modified version of this trailer has been certified for air transportation of a similar launch vehicle. The certification for air transportation of the USAF *ait* version of the trailer will be accomplished prior to shipment. This trailer is also DoD approved for transporting high explosives on public roads. Even though there have been transporter vehicle mishaps there has never been a rocket motor detonation. Similar rocket motor configurations have been transported on public roads from Hill AFB, Utah to White Sands Missile Range (WSMR), New Mexico over a dozen times. The roads to WSMR are dirt roads similar to the gravel roads leading to KLC. Consequently, potential health and safety impacts from transporting missile components are not expected to be significant.

5. The assembly of missile components, accomplished within enclosed facilities at KLC, has the potential to affect worker health and safety but, due to the design of the facilities, not

public health and safety. Assembly activities are considered routine and are conducted in accordance with established regulations and applicable DoD procedures. As a result, potential impacts to worker health and safety are not considered significant.

6. Prelaunch evacuations, clearances and road closures will be conducted to assure safety for workers and the public for both a normal launch and an aborted launch of the USAF *ait* test vehicle. The impacts of these closure activities are not considered to be significant. Prior to launch, in accordance with DoD range safety procedures, the range safety officer will be responsible for the planning and control of evacuation activities to assure the safety of all persons within the flight path of the USAF *ait* test vehicle. The safety exclusion zone around the launch pad for the launch of the USAF *ait* test vehicle is a radius of up to 10,000 feet, as shown in Figure 4.5-1. However, further detailed analysis for the two USAF *ait* launches may favor the use of a smaller exclusion zone. Evacuation includes establishing appropriate roadblocks at least four hours prior to launch activities, and to no more than one hour after launch, coordinating and assisting local authorities, and conducting appropriate ground and air surveillance sweeps to assure that all areas are evacuated in accordance with agreements between the NAWC and state and federal agencies. Medical and fire response units will be permitted to pass through roadblocks in the performance of their duties, depending on time remaining prior to launch.

7. Based on public comment on the Draft EA, the following information is provided: The U.S. Coast Guard Loran Station Kodiak (LORSTA Kodiak) is normally unoccupied. Should personnel be present, there may be a requirement to evacuate LORSTA Kodiak during the USAF *ait* launch period, approximately five hours. The final analysis of the launch site safety zone will determine which facilities and area must be cleared prior to a launch. If emergency maintenance is required at LORSTA Kodiak, the launch will be delayed until LORSTA Kodiak is operational and the area is clear. During the launch period the U.S. Coast Guard will have access to the USAF *ait* countdown communication network and have the capability to delay the launch if required.

8. Personnel inside the launch hazard area would be limited to those considered mission essential, and would remain within facilities rated to provide adequate blast and debris protection and to which positive communications would be maintained at all times. Nonessential personnel would be evacuated to outside the impact limit line. Mission-essential personnel would be instructed in safety procedures and equipped with any necessary safety devices.

9. As a result of the above procedures, the potential for health and safety impacts associated with the USAF *ait* program is not considered to be significant for program personnel and the public. The population of Kodiak Island is well removed from KLC and the flight path of the USAF *ait* vehicle.

4.5.1.2 Range Safety

4.5.1.2.1 Prelaunch Activities

1. Although there is no existing test range associated with the proposed action, standard range safety for the USAF *ait* program will be in accordance with procedures established for Sea Test Ranges at the Naval Air Warfare Center Weapons Division (NAWC), Point Mugu, California and the Pacific Missile Range Facility (U.S. Navy, 1997). NAWC has extensive experience in providing range safety support worldwide.

2. Based on public comments on the Draft EA, the following information is provided: Launches by their very nature involve some degree of risk and it is for this reason that DoD has specific launch and range safety policies and procedures to assure that the public and government assets (i.e., launch support facilities) are not put at risk. The following documents will be published by the NAWC prior to the first proposed deployment of the USAF *ait* test vehicle:

   - Range Safety Operation Plan
   - Formal Range Safety Approval of Flight Termination System
   - Hazardous Operation Procedures
   - Ground Safety Plan
   - Communication Plan
   - Frequency Coordination Plan

   These procedures provide for range surveillance, clearance and air traffic control. The NAWC range safety officer will be responsible for implementing range safety plans and approvals.

3. Based on public comments on the Draft EA, the following information is provided: DoD has successfully launched eight vehicles that consisted of the same configuration of Minuteman II second and third stages that would be used by the USAF *ait* test vehicle. Additionally, DoD has launched 99 various configurations of two and three stage excess ballistic missiles for a number of years, with a success rate of 96 percent.

4. The NAWC will establish ground hazard areas at the launch site area and areas over the ocean beyond where debris from an early flight termination may fall (early termination is not expected). Failure of a missile guidance system that would cause debris to fall outside the ground and launch hazard areas would be detected by the range safety officer, who would terminate the missile flight before it could cross the hazard area (Navy Air Warfare Weapons Division, 1997). The range safety program includes redundant airborne command destruct systems aboard two Navy NP-3D Orion aircraft that will permit in-flight tracking of the USAF *ait* test vehicle. The remote area safety aircraft will be used for real-time monitoring of missile performance and evaluation of flight termination criteria (U.S. Navy, 1997).

5. This NAWC-provided range clearance and surveillance will occur for three designated areas of potential impact:
   - Ground Hazard Area - Prior to launch, all personnel not designated as "essential" will be evacuated from the ground hazard area shown in Figure 4.5-1.
   - Flight Hazard Area-there will be every practical effort to keep this area clear of nonparticipating aircraft and ships by establishing warning and restricted areas, publishing notices to airmen and mariners and by maintaining close liaison and coordination with agencies controlling both air and surface traffic (U.S. Navy, 1993).
   - USAF *ait* Test Vehicle Impact Area-All intended impact areas and the applicable airspace above will be surveyed to assure that ships or aircraft are not in the vicinity at the proposed time of impact, as necessary (U.S. Navy, 1993).

6. Prelaunch hazardous operations will be conducted in accordance with established procedures that implement applicable DoD regulations. Prior to launch, positive control of hazardous areas will be established. Unauthorized entry into hazard areas will result in delay of the operation until the "All Clear" signal has been reestablished. The USAF *ait* test vehicle will be launched only after all required safety evacuations have been accomplished, thereby assuring that no unauthorized personnel are present in any hazardous area.

7. Based on public comments on the Draft EA, the following information is provided: The USAF *ait* program is working closely with the U.S. Coast Guard and NAWC on RF issues. Possible RF signal interference will be analyzed and, if necessary, the USAF *ait* telemetry will be modified to eliminate interference. The USAF *ait* rocket motor vulnerability to signal

strength intensity will be evaluated. Based upon the results, the USAF *ait* program will take whatever steps are necessary to preclude inadvertent detonation. Decisions and agreements required for RF protection will be submitted to the U.S. Coast Guard for coordination prior to implementation.

4.5.1.2.2 Flight Activities

1. During missile flight operations, the potential impact zone includes the launch pad and surrounding area, and all locations along the flight corridor. The impact zone for public safety includes those areas within and adjacent to the site within up to a 10,000-foot radius of the launch pad. However, further detailed analysis for the two USAF *ait* launches may favor the use of a smaller exclusion zone. The public will be excluded well outside the potential impact zone.

2. The principal concerns are launch-site and in-flight malfunctions. A missile may malfunction on the launch pad or may deviate from its anticipated flight path after takeoff, requiring the flight to be terminated. Debris resulting from a launch-site malfunction can result in the scattering of missile debris anywhere within the launch hazard area, which would have been cleared of all nonessential individuals prior to the launch. Debris resulting from an in-flight malfunction would impact within the flight corridor footprint shown in Figure 4.5-1. Impacts would not be significant.

3. The USAF *ait* vehicle will have an in-flight termination system, capable of terminating thrust and/or aerodynamic lift, or destroying the missile throughout the entire powered portion of the flight. The NAWC will initiate flight termination action when:

   - Data indicate that the missile impact point will violate impact limit lines and impact outside the designated protected impact area.
   - Position of missile is unknown due to the loss of tracking data.
   - Vehicle has the potential to violate range safety impact limit lines.
   - Missile performance diminishes such that continuation of flight creates a safety hazard and loss of range safety control.

   Such system provides a mechanism so that impact limit lines would not be violated in the event of a malfunction during flight. Therefore, potential impacts would not be significant.

4.5.1.2.3 Post-Flight Activities

In the event of a flight termination, debris-recovery activities would be conducted in accordance with DoD regulations and would not pose an impact to public health and safety. Any mishap would be investigated in accordance with established USAF procedures (AFI 91-204).

4.5.2 CUMULATIVE IMPACTS

1. The two USAF *ait* launches require thorough health and safety planning at the earliest stages, and health and safety requirements are implemented during all phases of operation. As a result, potential health and safety hazards are avoided or reduced to extremely low probabilities. Cumulative impacts from the two USAF *ait* launches will not be significant as compared with other past, present, or reasonable foreseeable future actions at the KLC.

2. The two USAF *ait* launches require evacuation of the KLC area and closure of all access roads, assuring that the public would not be exposed to any health or safety hazards. Consequently no cumulative impacts to public health and safety are expected to occur.

4.5.3 NO ACTION ALTERNATIVE

Under the No Action alternative, there would be no impacts, as the two USAF *ait* launches would not occur.

4.6 HAZARDOUS MATERIALS AND WASTE

4.6.1 PROPOSED ACTION

4.6.1.1 <u>Gas Phase Emissions</u>

As discussed in Section 4.2, some potentially hazardous substances would be released from the solid rocket propellant during launch of the two USAF *ait* test vehicles. The primary gas phase hazardous substance released from the USAF *ait* test vehicle is HC1, with an instantaneous concentration below 0.5 ppm and a 60-minute mean concentration below 0.025 ppm. Peak concentrations are expected to occur at unpopulated locations downwind of the launch site. Exposure to these levels is not expected to be harmful to individuals. Other gas phase pollutant concentrations will be an order of magnitude smaller and would not be harmful to individuals. Therefore, impacts related to exposure to these substances would not be significant.

4.6.1.2 USAF *ait* Vehicle Components

1. Both motors for the USAF *ait* test vehicle contain solid propellant, the constituents of which are itemized in the following:

   - First Stage (Class 1.3 Hazard Classification):
     - Ammonium Perchlorate
     - Aluminum
     - Polybutadiene (as binder)
   - Second Stage (Class 1.1 Hazard Classification):
     - Nitroglycerin
     - 2-Nitrodiphenylamine (2-NDPA)
     - Nitrocellulose
     - Cyclotetramethylenetetranitramine (HMX)
     - Aluminum
     - Ammonium Perchlorate
     - Resorcinol (1,3-Dihydroxybenzene)
     - Triacetin
     - Graphite

2. The potentially hazardous substances associated with the USAF *ait* test vehicle are contained within the various subassemblies and motors of the vehicle. Therefore, under nominal operating conditions, no hazardous materials are released before launch.

3. The USAF *ait* first stage flight control mechanism, the thrust vector control system, begins the flight with 1.85 gallons of hydraulic fluid which is vented during flight, resulting in up to 90 percent of the fluid being used during the mission. The second stage flight control mechanism is a closed system which contains 0.06 gallon of hydraulic fluid. While in flight, the hydraulic fluid released from the first stage will be vaporized as a result of vehicular velocity and dissipated by stratospheric winds. The second stage hydraulic reservoir is expected to survive the splashdown intact. Over time, the container is expected to decompose, thus allowing the 0.06 gallon of hydraulic fluid to be released. Subsurface currents will cause rapid dispersion of this very small quantity to be spread over a large area; therefore, there would be no significant impact to marine mammal or fish species.

4. The first stage of the USAF *ait* test vehicle may contain approximately 25 lbs of residual propellant at splashdown. The second stage may contain less than 1 lb of residual propellant at splashdown. In addition, the first stage will contain approximately 0.18 gallon of hydraulic fluid at splashdown, and the second stage will contain approximately 0.06 gallon

at splashdown. Subsurface currents will cause rapid dispersion of these small quantities to be spread over a large area; therefore, there would be no significant impact to marine mammal or fish species.

5. There are seven batteries on board the USAF *ait* test vehicle, one of which is composed of 600 milliliters (37 cubic inches) of water with a 33 percent concentration of potassium hydroxide (KOH). The other six batteries are composed of nickel and cadmium. The batteries are expected to survive the impact with the water and will decompose over time. Subsurface currents will cause rapid dispersion of materials released from the batteries; therefore, there would be no significant impact to marine mammal or fish species.

6. As discussed above, due to rapid dispersion of the small quantities of materials released in the ocean from the expanded first and second stages of the USAF *ait* test vehicle and the instrumentation package, there would be no significant impact to marine mammal or fish species.

4.6.2 CUMULATIVE IMPACTS

The two USAF *ait* launches are planned the period from July through September 1998 and March 1999. Cumulative impacts related to release of gas-phase emissions and the release of residual materials from the expended stages of the USAF *ait* test vehicles would not be significant as compared with other past, present, or reasonable foreseeable future actions at the KLC.

4.6.3 NO ACTION ALTERNATIVE

Under the No Action alternative, the two launches of the USAF *ait* test vehicles would not occur. As a result, none of the impacts described would occur.

4.7 KLC CONSTRUCTION

1. The original 18 month construction time estimate in the FAA EA covered all potential construction aspects of AADC's proposed action. Since the issuance of the FAA EA, the AADC has received Alaska state funding and has completed several preliminary actions, to include pre-qualification of contractors. A construction support team has been established and has been working to develop an effective construction strategy to include the

introduction of more off-the-shelf components and a streamlined materials ordering process. The potential contractors have complete drawing sets and specifications and are familiar with the requirements. AADC has provided contractors with clarifications as needed to support a rapid construction start-up. These actions have reduced the administrative and construction schedule. Thus, AADC has been able to adjust the original FAA EA schedule without changing the construction personnel or equipment utilization described in the FAA EA.

2. As a result of these factors, the USAF has concluded that the schedule analyzed in the USAF EA for completing the three facilities at KLC to support the two USAF *ait* launches, will have no significant impacts on the environment.

CHAPTER 5.0
MITIGATION MEASURES

5.0 MITIGATION MEASURES

5.1 GEOLOGY AND SOILS, WATER, LAND USE, SOCIOECONOMICS, RECREATION, VISUAL AND CULTURAL RESOURCES

The FAA EA has been reviewed regarding mitigations for potential impacts to Kodiak Island from the proposed processing and launch of the USAF *ait* test vehicle. The USAF adopts the analysis and conclusions of the FAA EA with regard to mitigation measures for geology and soils, water, land use, socioeconomics, recreation, and visual and cultural resources. The FAA EA is included as Attachment 1 to this USAF EA.

5.2 AIR QUALITY

Pre/postlaunch ground operations to support the USAF *ait* program at KLC, as executed by the USAF, are the same as those proposed by the AADC and do not substantially change the impacts as related to such activity. The USAF adopts the analysis and conclusions of the FAA EA with regard to mitigation measures associated with potential air quality impacts.

5.3 BIOLOGICAL RESOURCES

1. The FAA EA has been reviewed regarding mitigations for potential impacts to biological resources from the proposed processing and launch of the USAF *ait* test vehicle. The USAF adopts the analysis and conclusions of the FAA EA with regard to mitigation measures for biological resources.

2. Because of the recent listing of the Steller's eider as a federal threatened species, and specific characteristics of the USAF *ait* test vehicle trajectory near Ugak Island and potential impacts to the Steller sea lion, the USAF will participate in the mitigation monitoring programs developed by FAA. In accordance with the Endangered Species Act, the USAF has completed informal Section 7 consultation with the USFWS for the first launch. In a letter dated October 28, 1997, the USFWS concurred with the USAF conclusion that the first proposed USAF *ait* launch is not likely to adversely affect threatened or endangered species, and stated that further consultation under Section 7 of the Endangered Species Act is not required at this time. USFWS's concurrence is based upon a proposed first launch date no earlier than July 1998, and upon an USFWS approved, fully funded, statistically valid USAF surrogate seabird monitoring plan being in place prior to the first USAF *ait* launch. The specific monitoring requirements are set forth in the October 28, 1997, USFWS letter in

Appendix D of the EA. Consultation pursuant to Section 7 of the Endangered Species Act will commence for the second launch (currently proposed for March 1999) within 30 days of the first launch, and will be based, in part, on the results of the monitoring efforts associated with the first launch. If the first launch is delayed past September 15, 1998, or if project plans change, additional information on listed or proposed species becomes available or new species are listed that may be affected by the project, the USAF will reinitiate consultation with the USFWS regarding the first USAF *ait* launch. Without the completion of the required additional consultation with, and approval by, the USFWS, the USAF will not conduct the first launch between September 15, 1998 and April 1999 to avoid the first launch occurring while the threatened Steller's eiders are present. The second launch will be conducted in accordance with the USFWS consultations regarding results of the monitoring that occurred prior to, during and after the first launch, so as to avoid adversely affecting threatened or endangered species.

3. The USAF will participate in monitoring programs established by FAA. For marine birds, which include the Steller's eider, monitoring includes surf-zone surveys from shore one day prior to launch and two to five days after each launch. Results of these surveys will be utilized to determine any changes in habitat-use patterns and whether there is evidence of site abandonment following a launch event. In addition, for the two USAF *ait* test vehicle launches, the USAF proposes to monitor onsite facilities to document any evidence of birds striking lights, with particular attention to any light strikes by Steller's eiders.

4. Based on public comments on the Draft EA, the following information is provided: The current plan is for the two USAF *ait* launches to occur outside the peak whale migratory periods of April through May and November through December. Before any proposed rescheduling of launches into these peak periods, the USAF would first consult with, and gain approval from NMFS.

5. Based on public comments on the Draft EA, the following information is provided: The USAF has consulted with the NMFS regarding the Steller sea lion haulout areas on Ugak Island. Because the USAF assessment of the potential impacts to Steller sea lions is based on the predicted rather than measured noise levels expected to occur from the USAF *ait* launches, the NMFS has requested and the USAF has agreed to perform NMFS approved monitoring of

Steller sea lion haulouts before, during and after the first USAF *ait* launch. The second USAF *ait* launch will be conducted in accordance with consultation with NMFS regarding the monitoring results from the first launch so as to avoid adversely affecting the Steller sea lion.

5.4 NOISE

The FAA EA has been reviewed regarding mitigations for potential noise impacts from the proposed processing and launch of the USAF *ait* test vehicle. The USAF adopts the analysis and conclusions of the FAA EA in regard to mitigation measures associated with potential noise impacts. Therefore, no additional mitigation measures are provided in this document. The reader is referred to the FAA EA for a discussion of mitigation measures for noise.

5.5 HEALTH AND SAFETY

1. The USAF will participate in the AADC emergency response plan for the KLC, as described in the FAA EA. Additionally, USAF will confirm that the established AADC quantity distance zones and launch facility design criteria for the KLC are sufficient to meet USAF requirements.

2. Prior to launch, positive control of hazardous areas will be established. Unauthorized entry into hazard areas will result in delay of the operation until the "All Clear" signal has been reestablished. The USAF *ait* test vehicle will be launched after required safety evacuations have been accomplished, thereby assuring that no unauthorized personnel are present in any hazardous area. Because established NWCS range safety procedures described in Section 4.5 would reduce potential impacts to less than significant, no additional mitigation measures would be required.

3. Possible RF signal interference will be analyzed and, if necessary, the USAF *ait* telemetry will be modified to eliminate interference. The USAF *ait* rocket motor vulnerability to signal strength intensity will be evaluated. Based upon the results, the USAF *ait* program will take whatever steps are necessary to preclude inadvertent detonation. Decisions and agreements required for RF protection will be submitted to the U.S. Coast Guard for coordination prior to implementation.

4. During a launch, various contingency plans will be in effect to cover emergency situations. These include, but are not limited to:

   - Rocket Motor Mishap: There will be an Explosive Ordnance Disposal Plan in place with appropriate personnel and equipment.
   - Fire: There will be a firefighting crew in place during launch countdown.
   - Injury: An evacuation plan will be in place to transport injured persons by appropriate means as dictated by seriousness of injury.

5.6 HAZARDOUS MATERIALS AND WASTE

The FAA EA has been reviewed regarding mitigations for hazardous substances related to operation of KLC. The USAF adopts the analysis and conclusions of the FAA EA in regard to mitigation measures associated with potential hazardous materials and waste. Therefore, no additional mitigation measures are provided in this document. The reader is referred to the FAA EA for a discussion of mitigation measures for hazardous materials.

CHAPTER 6.0
INDIVIDUALS AND AGENCIES CONSULTED

6.0 INDIVIDUALS AND AGENCIES CONSULTED

1. The following individuals and agencies were consulted or provided information during preparation of this EA:

- **Agencies**
  - Federal Aviation Administration
    Office of the Associate Administrator for Commercial
    Space Transportation
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7.0 LIST OF PREPARERS

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CHAPTER 8.0
REFERENCES AND RESOURCES

8.0 REFERENCES AND RESOURCES

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TABLES

TABLE 1.1

OPERATIONAL PERMITS AND APPROVALS FOR THE KODIAK LAUNCH COMPLEX

ACTIVITY	REQUIREMENT	BASIS	AUTHORITY	AGENCY	COMMENTS
			Federal		
KLC[1] Operation	Environmental Review	Major Federal action affecting the environment.	• National Environmental Policy Act (42 USC 4321 et seq.) • 40 CFR 1500 et seq.	USAF	Environmental assessment preparation.
KLC Construction and Operation	Consultation	Potential impact to threatened and endangered species.	• Endangered Species Act Section 7 (16 USC 1536) • 50 CFR 402	U.S. Department of Interior, Fish and Wildlife Service U.S. Department of Commerce, National Marine Fisheries Service	Consultation initiated.
KLC Construction and Operation	Consultation	Potential impact to cultural resources.	• National Historic Preservation Act Section 106 (16 USC 470f) • 36 CFR 800	See comments	Requires consultation with State Historic Preservation Office. Consultation complete (negative determination).
KLC Construction and Operation	Certification	Potential to affect state water quality standards.	• Clean Water Act Section 401 (33 USC 1341)	Alaska Department of Environmental Conservation	Certification issued.
KLC Construction and Operation	Consistency Review	Activity within coastal area.	• Coastal Zone Management Act (AS[2] 46.40) • 6 AAC[3] 50, 80, and 85	Alaska Office of the Governor	Final consistency determination issued.
Water Withdrawal from East Twin Lake	Permit	Appropriation of state waters.	• AS 46.15.030 et seq. • 11 AAC 72	Alaska Department of Natural Resources, Division of Mining and Water Management	Permit issued.

97-249 Tbls&Figs (10/30/97/js)

(1) KLC= Kodiak Launch Complex.
(2) AS = Alaska Statutes.
(3) AAC= Alaska Administrative Code.

TABLE 2.1

EXISTING DoD LAUNCH SITES

SITE	RADAR COVERAGE	NO OVERFLIGHT	LOGISTICS	WEATHER	WITHIN RANGE
Wake Island	Yes	Yes	Yes	Yes	**No**
Kauai (Barking Sands)	Yes	**No**	Yes	Yes	**No**
White Sands Missile Range	**No**	**No**	Yes	Yes	Yes
Eastern Test Range - Cape Canaveral AFS	**No**	**No**	Yes	Yes	**No**
Western Test Range - Vandenberg AF	**No**	Yes	Yes	Yes	N/A

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Bold = Indicates site fails to meet selection criteria.
N/A = Not applicable.

TABLE 2.2

ALTERNATIVE SITES IN ALASKA

SITE	RADAR COVERAGE	NO OVERFLIGHT	LOGISTICS	WEATHER	WITHIN RANGE
Poker Flats	Yes	**No**	Yes	Yes	**No**
Elmendorf AFB	Yes	**No**	Yes	Yes	Yes
Point Barrow	Yes	**No**	**No**	Yes	**No**
Adak Island	Yes	Yes	**No**	Yes	**No**
Kodiak Island - Narrow Cape	Yes	Yes	Yes	Yes	Yes

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Bold = Indicates site fails to meet selection criteria.

TABLE 4.4-1

SOUND LEVELS AND LOUDNESS OF ILLUSTRATIVE NOISES IN INDOOR AND OUTDOOR ENVIRONMENTS (A-Scale Weighted Sound Levels)

dB(A)	OVERALL LEVEL (Sound Pressure Level Approx. 0.0002 Microbar)	COMMUNITY (Outdoor)	HOME OR INDUSTRY	LOUDNESS (Human Judgment of Different Sound Levels)
130	UNCOMFORTABLY LOUD	Mil. Jet Aircraft Take-Off w/After-burner From Aircraft Carrier @ 50 Ft. (130)	Oxygen Torch (121)	120 dB(A) 32 Times as Loud
120 110		Turbo-Fan Aircraft @ Takeoff Power @ 200 Ft. (90)	Riveting Machine (110) Rock-N-Roll Band (108-114)	110 dB(A) 16 Times as Loud
100	VERY LOUD	Jet-Flyover @ 1,000 Ft. (103) Boeing 707.DC-8 @ 6,080 Ft. Before Landing (106) Bell J-2A Helicopter @ 100 Ft. (100)		100 dB(A) 8 Times as Loud
90		Power Mower (96) Boeing 737, DC-9 @ 6,080 Ft. Before Landing (97) Motorcycle @ 25 Ft. (90)	Newspaper Press (97)	90 dB(A) 4 Times as Loud
80		Car Wash @ 20 Ft. (89) Prop. Airplane Flyover @ 1,000 Ft. (88) Diesel Truck, 40 MPH @ 50 Ft. (84) Diesel Train, 45 MPH @ 100 Ft. (83)	Food Blender (88) Milling Machine (85) Garbage Disposal (80)	80 dB(A) 2 Times as Loud
70	MODERATELY LOUD	High Urban Ambient Sound (80) Passenger Car, 65 MPH @ 25 Ft. (77) Freeway @ 50 Ft. From Pavement Edge, 10:00 AM (76 + or - 6)	Living Room Music (76) TV-Audio, Vacuum Cleaner	70 dB(A)
60		Air Conditioning Unit @ 100 Ft. (60)	Cash Register @ 10 Ft. (65-70) Electric Typewriter @ 10 Ft. (64) Dishwasher (Rinse) @ 10 Ft. (60) Conversation (60)	60 dB(A) 1/2 as Loud
50	QUIET	Large-Transformers @ 100 Ft. (50)		50 dB(A) 1/4 as Loud
40		Bird Calls (44) Lower Limit Urban Ambient Sound (40)		40 dB(A) 1/8 as Loud
	JUST AUDIBLE	(dB[A] Scale Interrupted)		
10	THRESHOLD OF HEARING			

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Source: Reproduced from Melville C. Branch and R. Dale Beland, Outdoor Noise in the Metropolitan Environment. Published by the City of Los Angeles, 1970, p. 2.

FIGURES

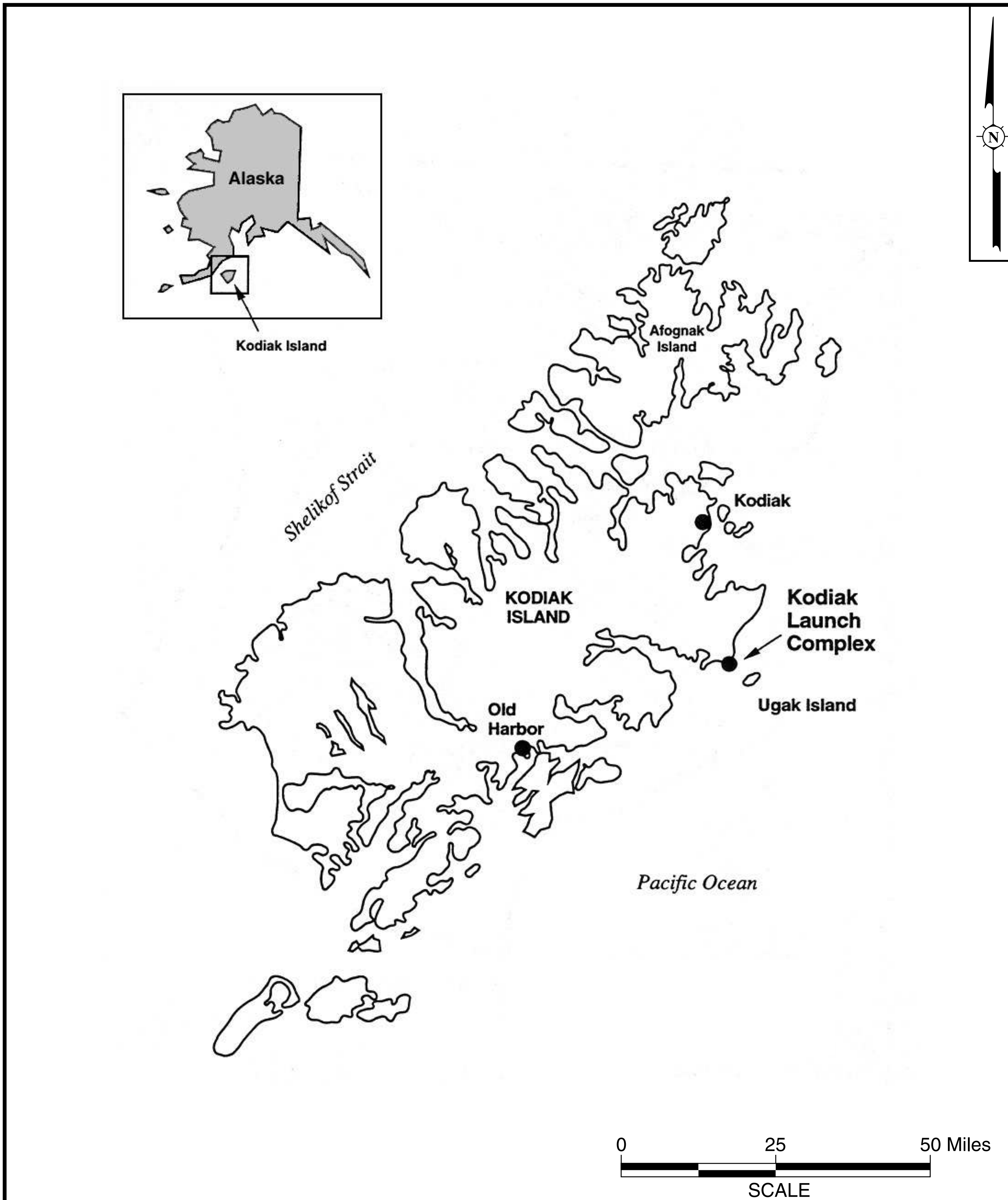


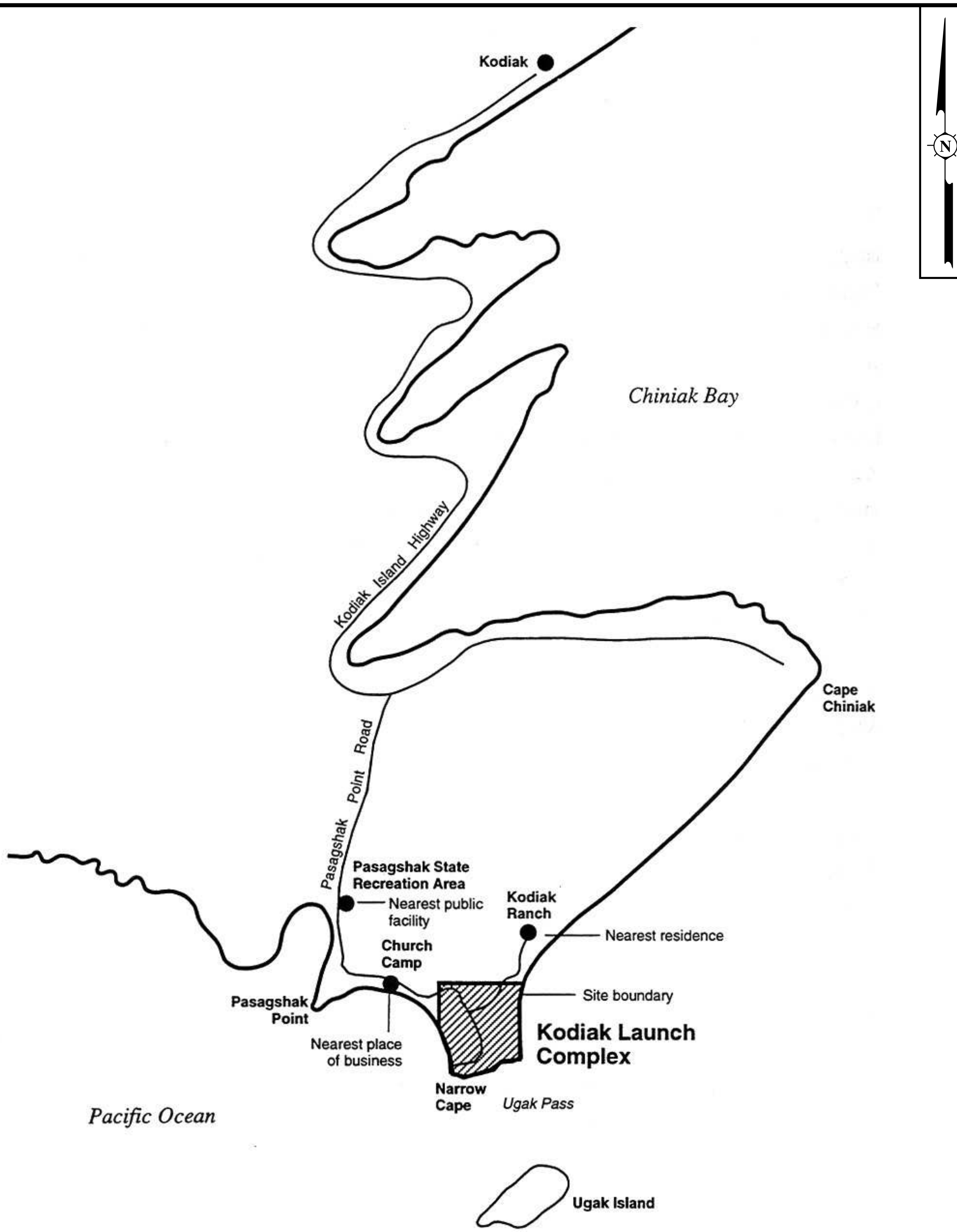
FIGURE 1.1

KODIAK LAUNCH COMPLEX SITE LOCATION

U.S. AIR FORCE
ait PROGRAM

Source: Modified from FAA June 1996.

TRC ENVIRONMENTAL SOLUTIONS, INC.



NOT TO SCALE

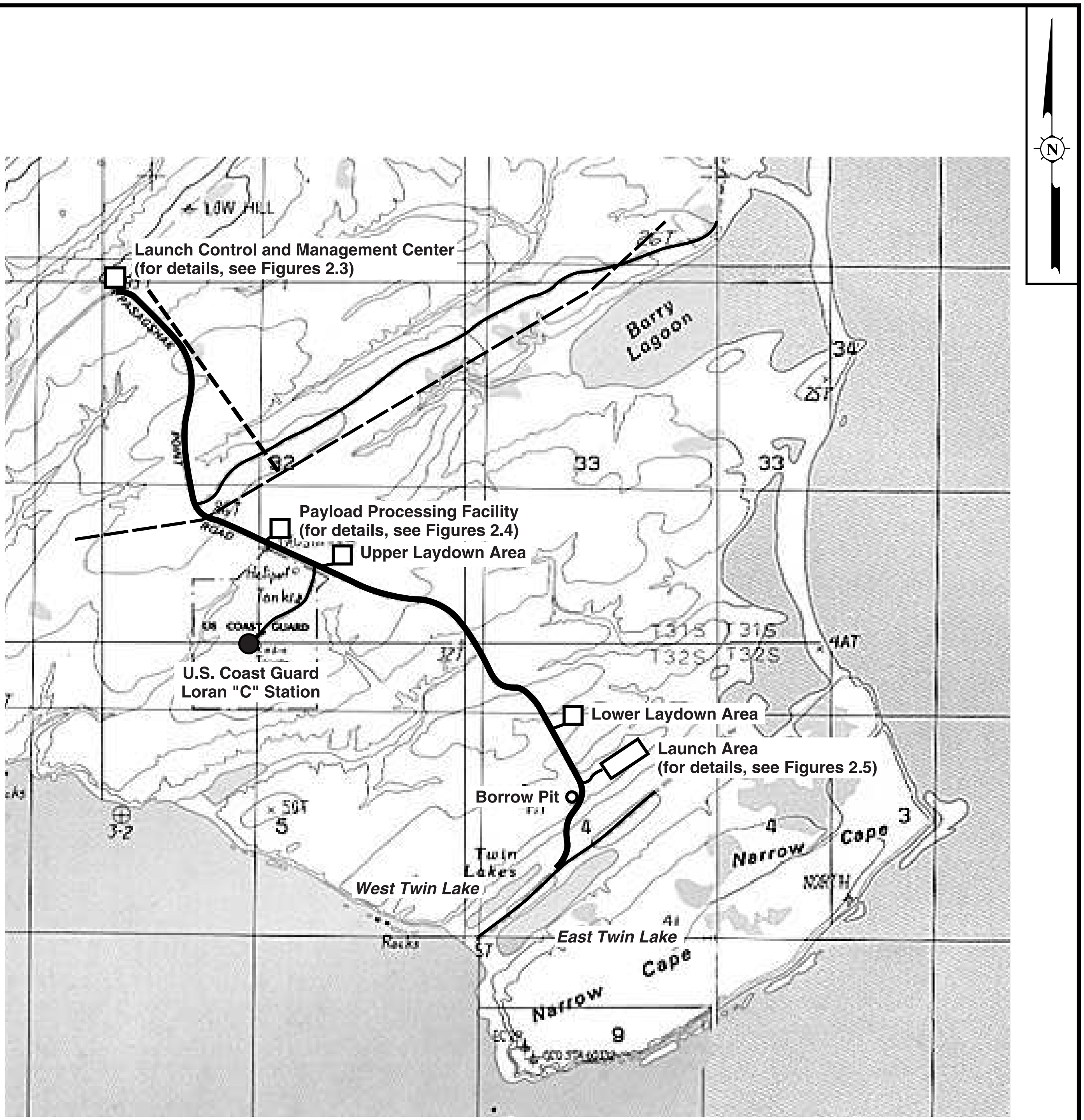
FIGURE 2.1

KODIAK LAUNCH COMPLEX AND VICINITY

U.S. AIR FORCE
ait PROGRAM

Source: Modified from FAA June 1996.

TRC ENVIRONMENTAL SOLUTIONS, INC.



LEGEND

- Existing Feature
- Existing Powerline
- Proposed Kodiak Launch Complex Feature
- Proposed Improvements to Existing Road and Installation of Underground Utilities
- Proposed New Powerline

Reference: Modified from FAA June 1996; USGS 7.5 Minute Topographic Quadrangle of Kodiak NE and Kodiak NW, Alaska, Dated 1987.

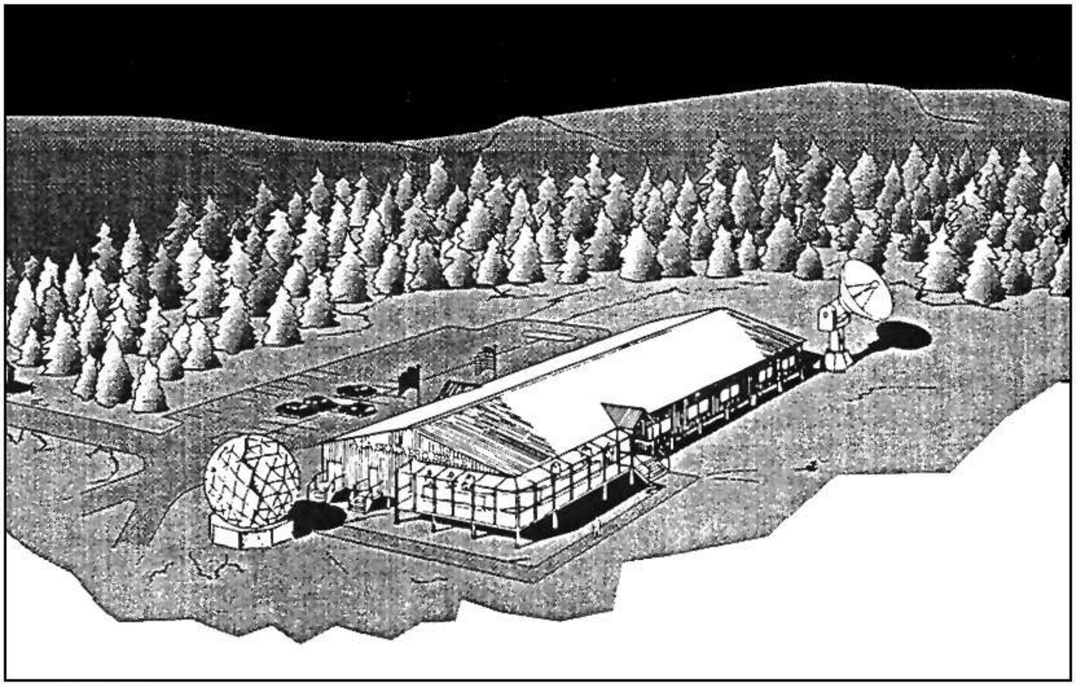
0 2,000 4,000 feet

SCALE

FIGURE 2.2

KODIAK LAUNCH COMPLEX FACILITY LAYOUT

TRC ENVIRONMENTAL SOLUTIONS, INC.



Artist's Rendition

PLAN VIEW

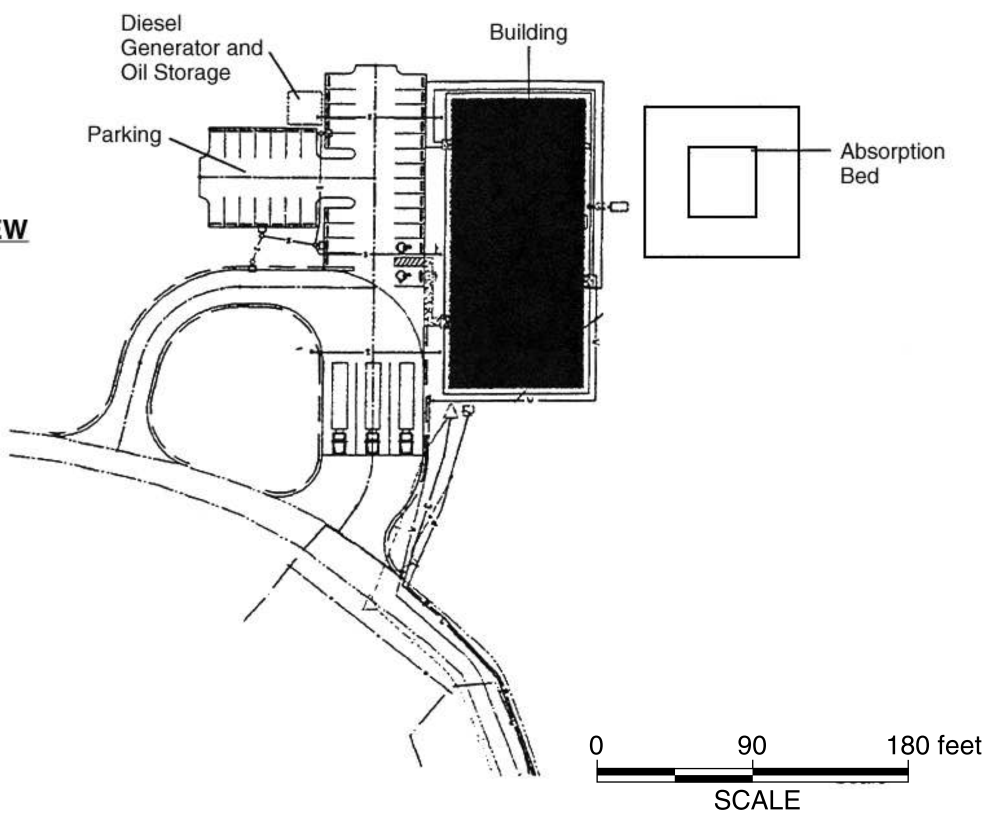
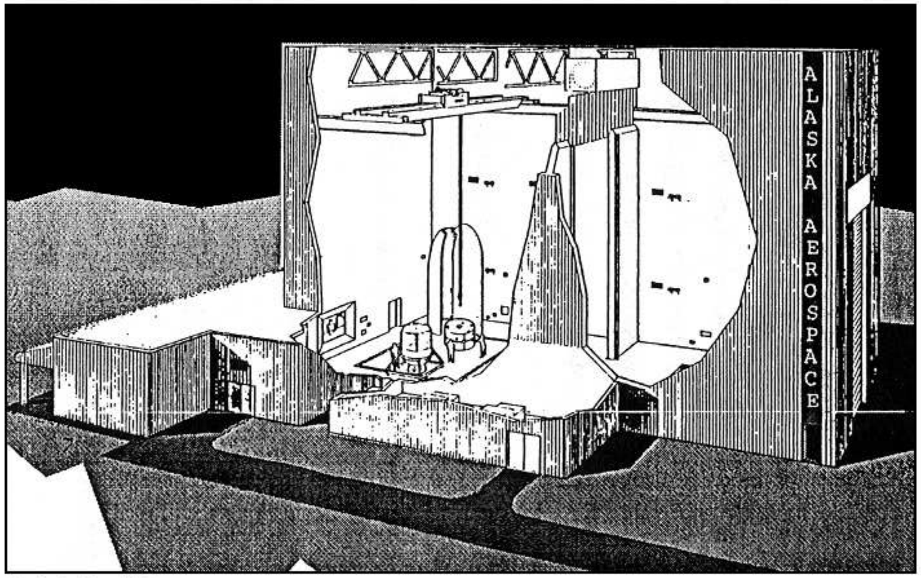


FIGURE 2.3

LAUNCH CONTROL AND MANAGEMENT CENTER

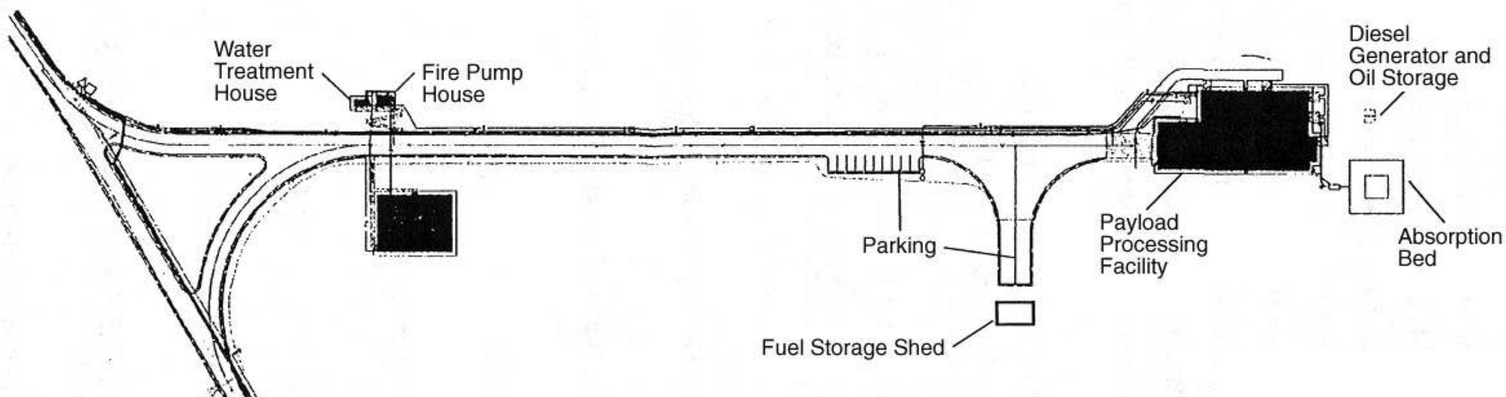
Source: FAA June 1996.

TRC ENVIRONMENTAL SOLUTIONS, INC.



Artist's Rendition

PLAN VIEW



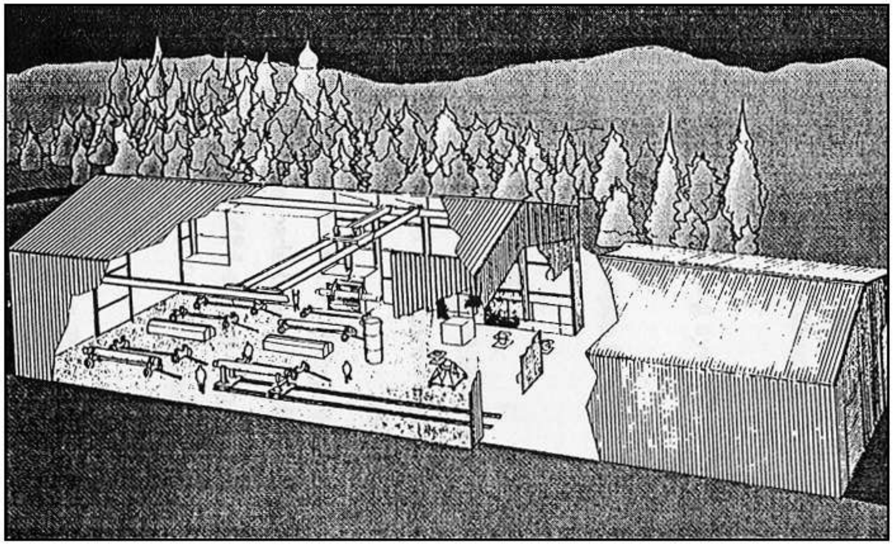
0 180 260 feet
SCALE

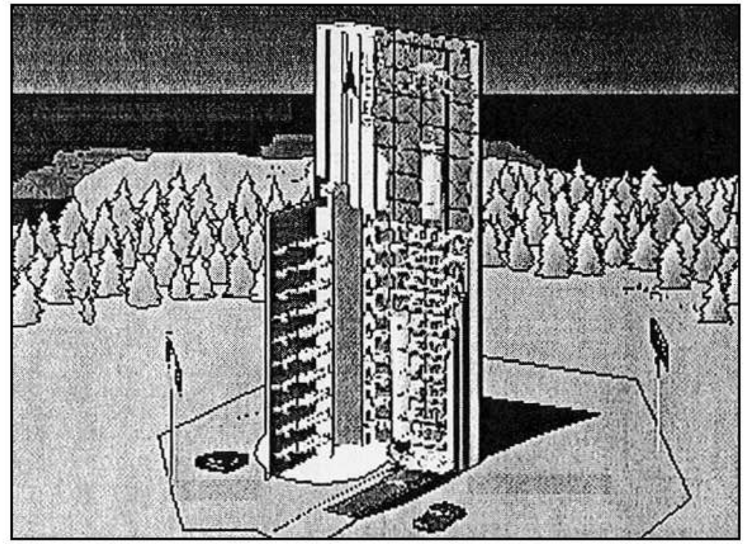
Source: FAA June 1996.

FIGURE 2.4

PAYLOAD PROCESSING FACILITY

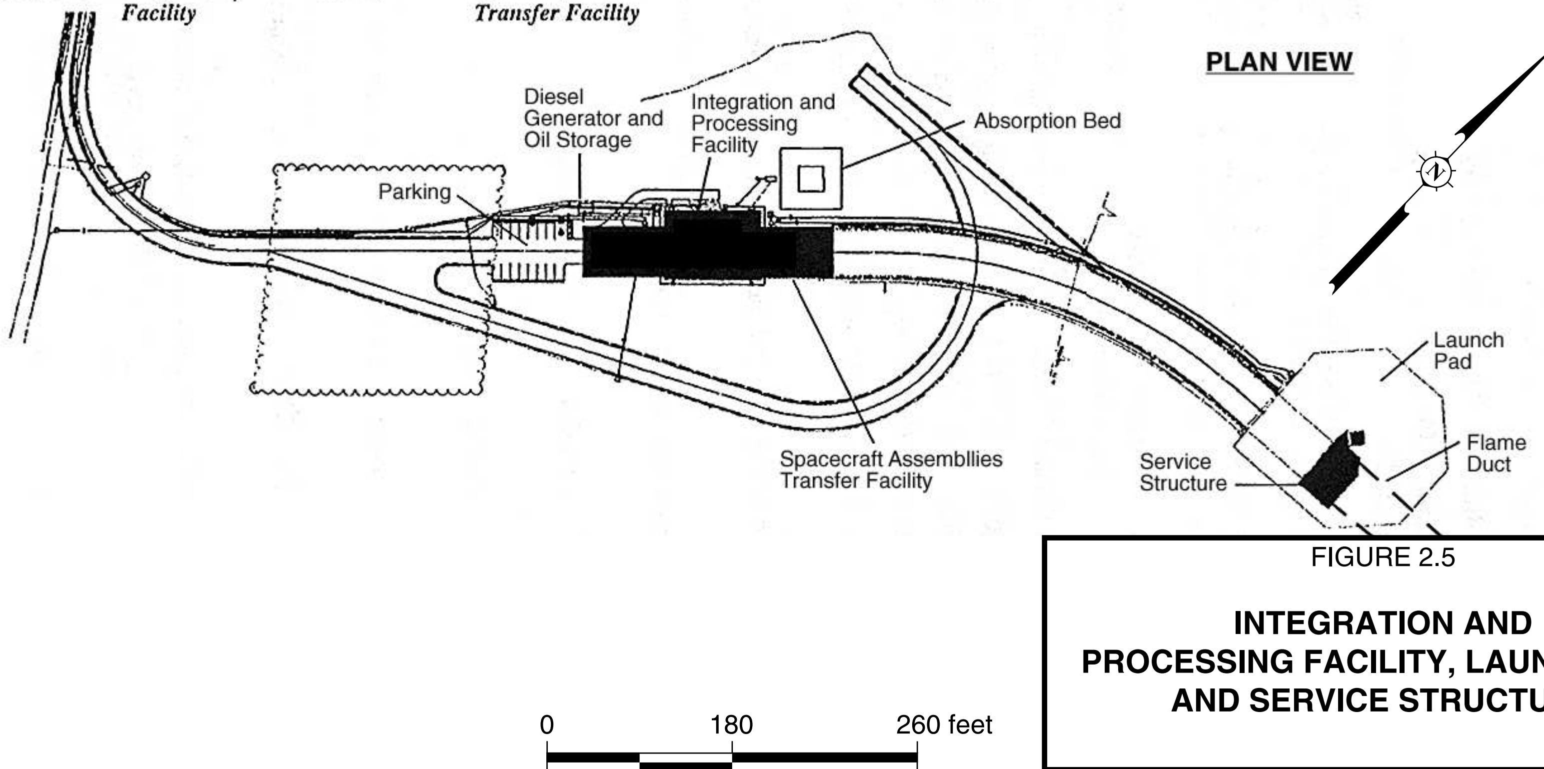
TRC ENVIRONMENTAL SOLUTIONS, INC.





Artist's Renditions *Integration and Processing Facility* *Spacecraft Assemblies Transfer Facility*

Launch Pad and Service Structure



Source: FAA June 1996.

FIGURE 2.5

INTEGRATION AND PROCESSING FACILITY, LAUNCH PAD AND SERVICE STRUCTURE

TRC ENVIRONMENTAL SOLUTIONS, INC.

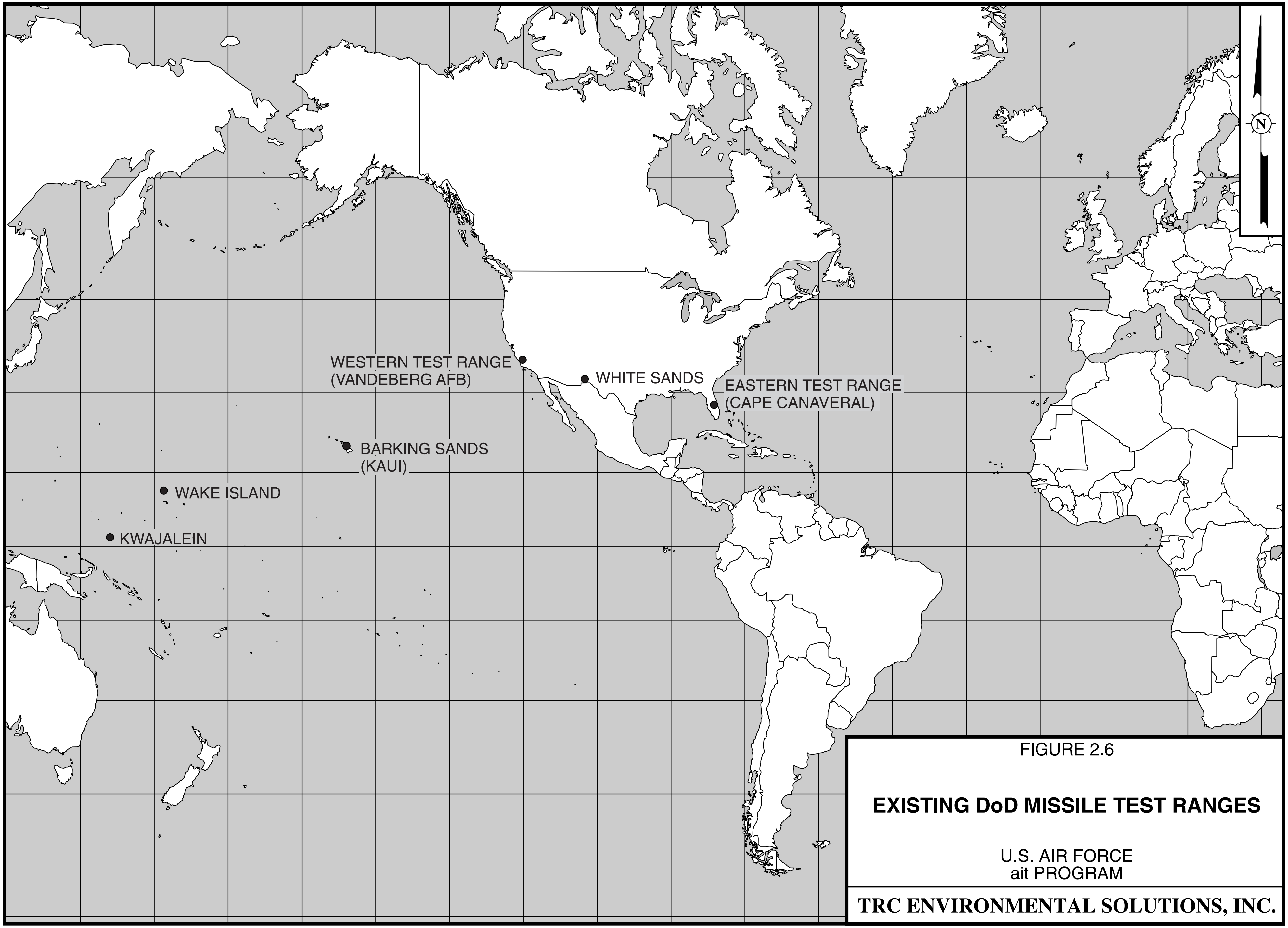
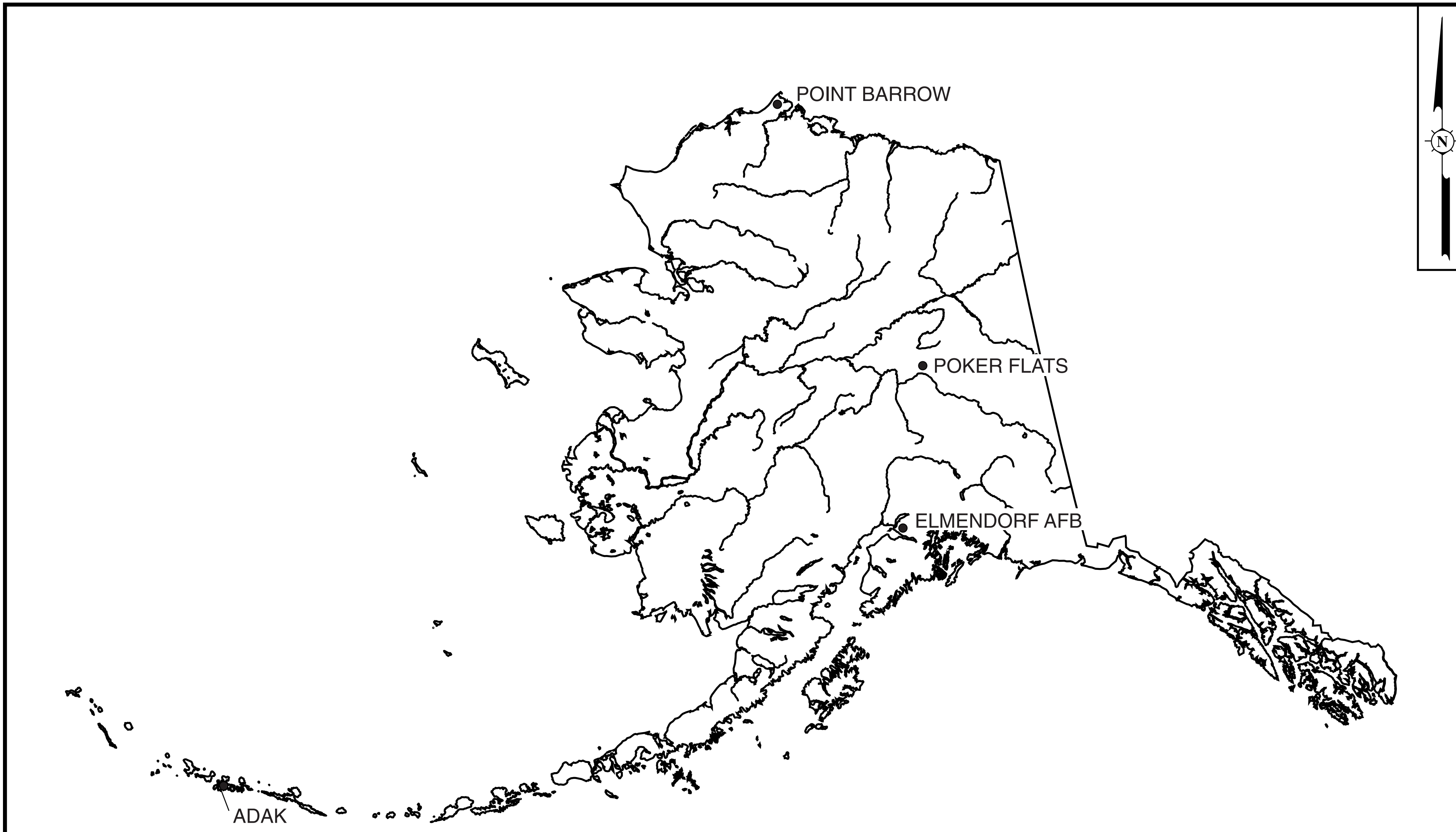


FIGURE 2.6

EXISTING DoD MISSILE TEST RANGES

U.S. AIR FORCE
ait PROGRAM

TRC ENVIRONMENTAL SOLUTIONS, INC.



0 200 400 feet

SCALE

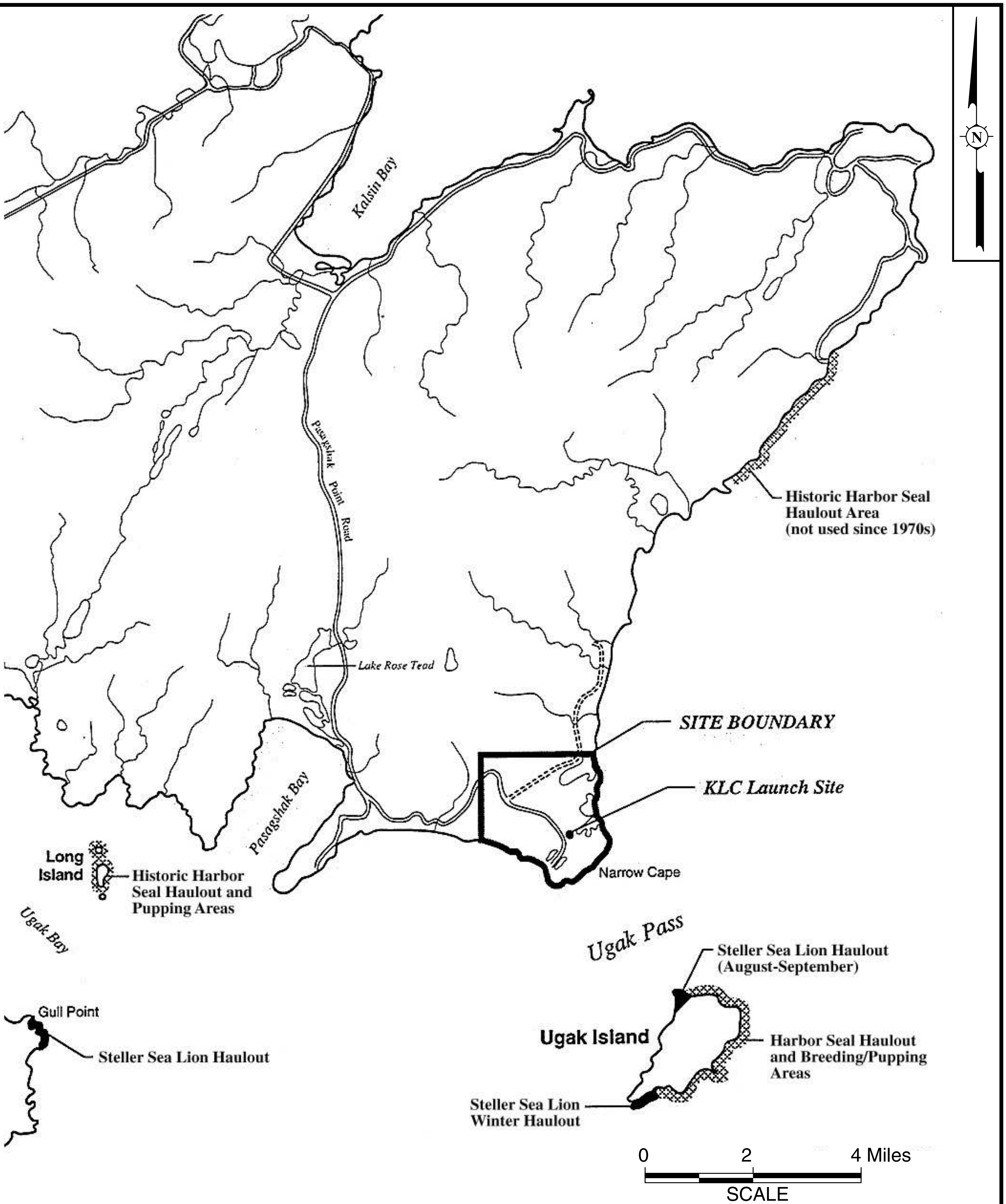
Source: FAA June 1996.

FIGURE 2.7

EXISTING DoD FACILITIES IN ALASKA

U.S. AIR FORCE
ait PROGRAM

TRC ENVIRONMENTAL SOLUTIONS, INC.



Source: Modified from FAA June 1996.

FIGURE 4.3-1

PINNIPED HAULOUTS IN KLC VICINITY

U.S. AIR FORCE
ait PROGRAM

TRC ENVIRONMENTAL SOLUTIONS, INC.

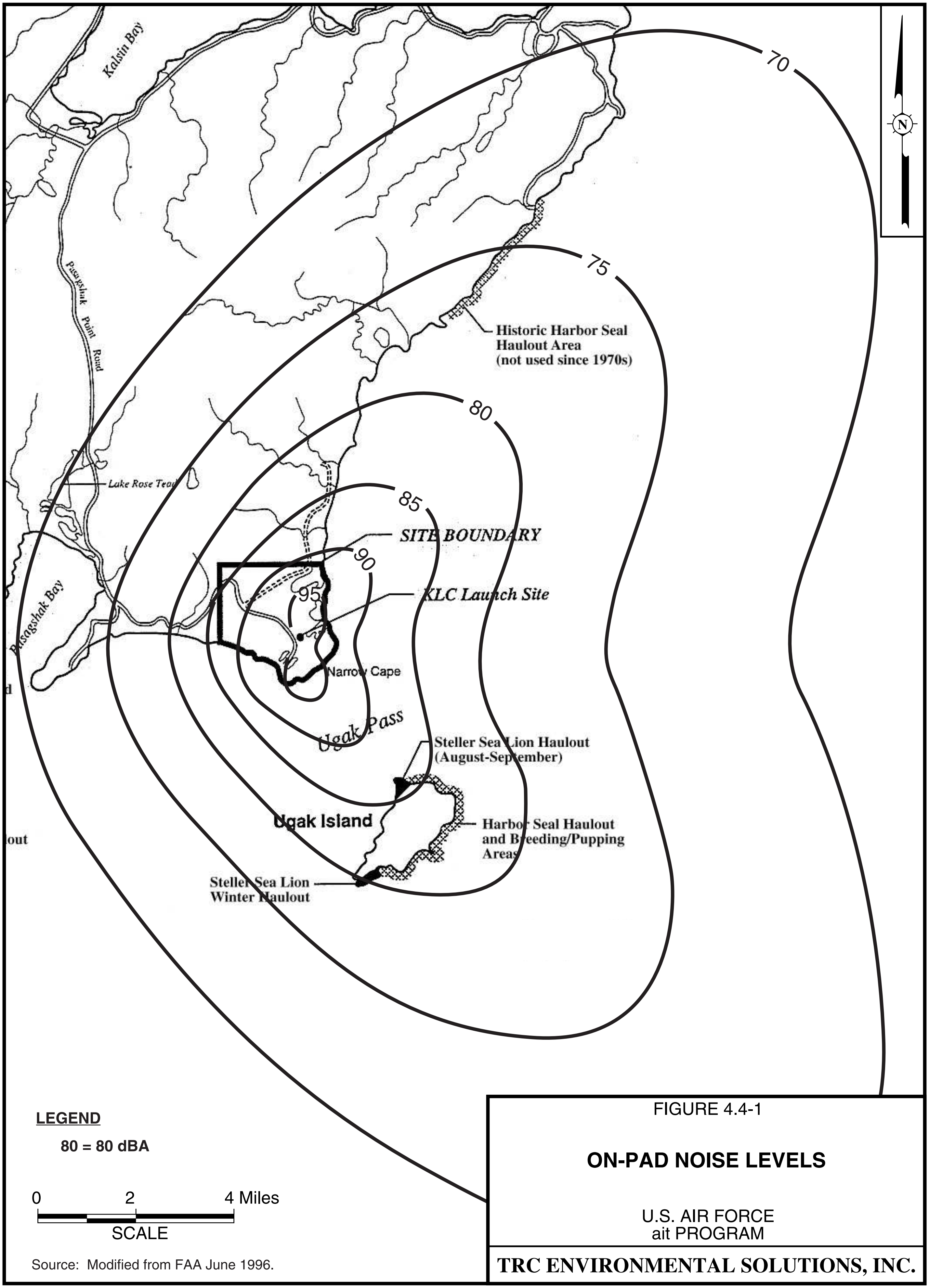
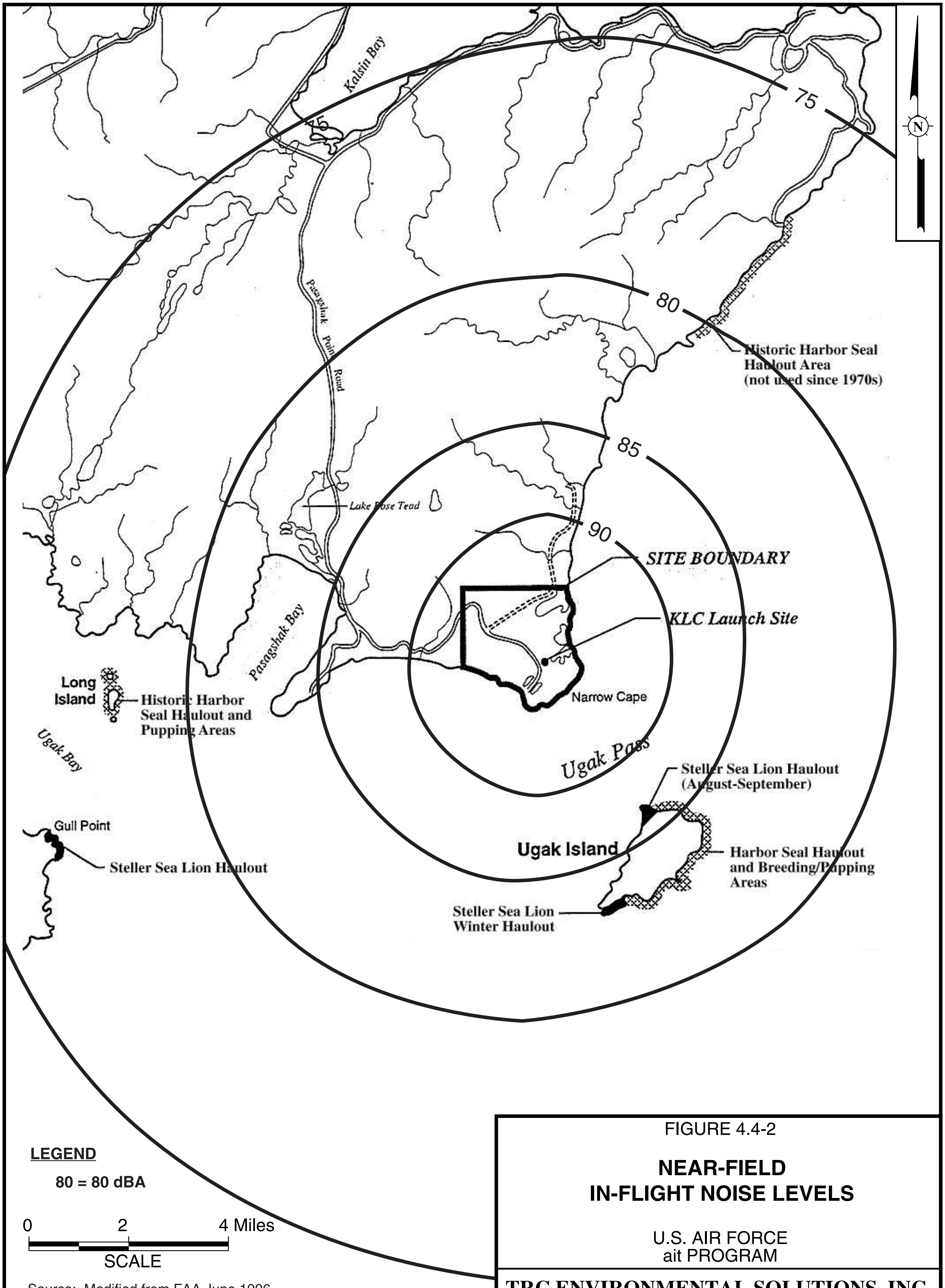


FIGURE 4.4-1

ON-PAD NOISE LEVELS

U.S. AIR FORCE
ait PROGRAM

TRC ENVIRONMENTAL SOLUTIONS, INC.



Source: Modified from FAA June 1996.

FIGURE 4.4-2

NEAR-FIELD
IN-FLIGHT NOISE LEVELS

U.S. AIR FORCE
ait PROGRAM

TRC ENVIRONMENTAL SOLUTIONS, INC.

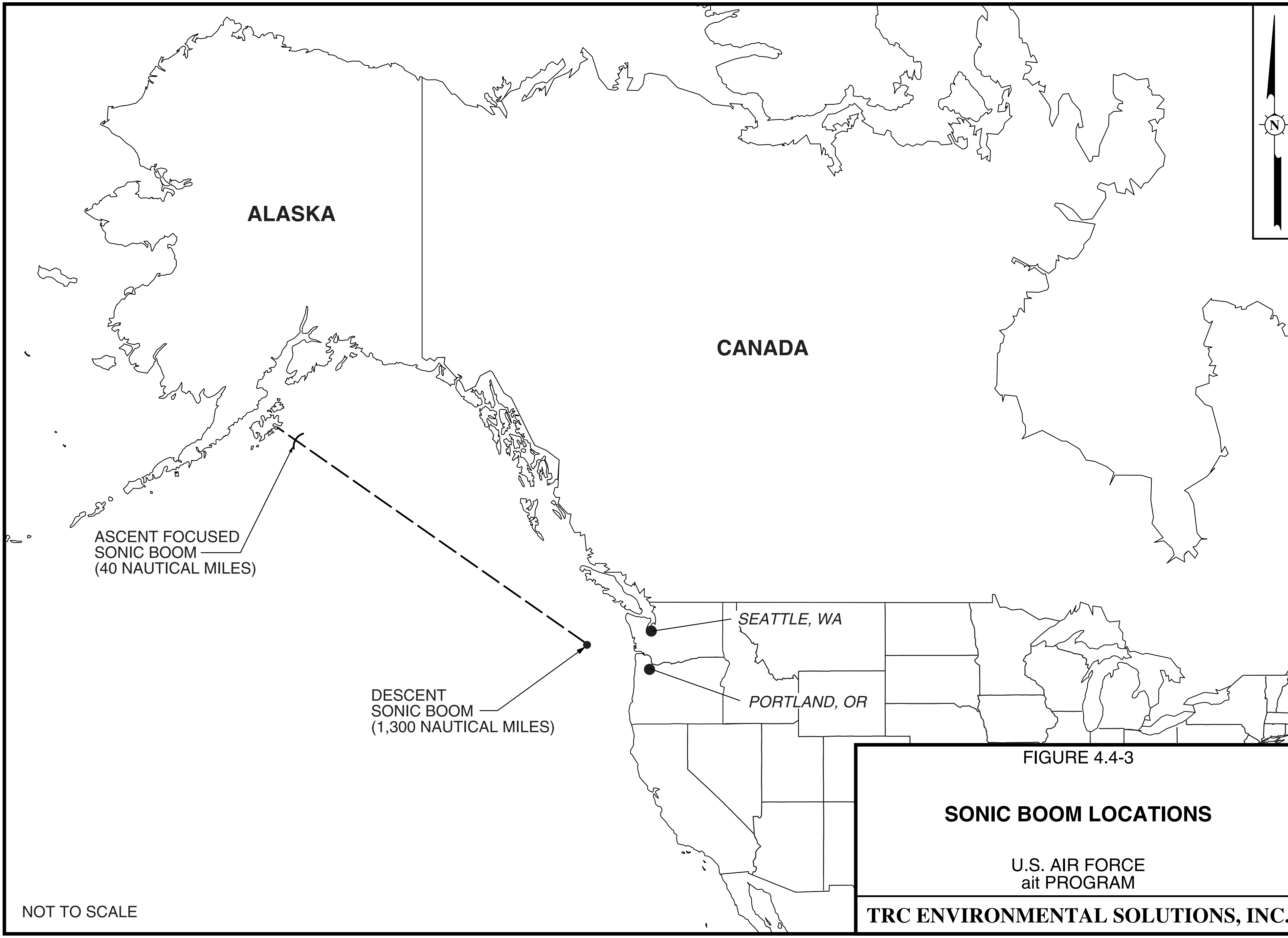


FIGURE 4.4-3

SONIC BOOM LOCATIONS

U.S. AIR FORCE
ait PROGRAM

TRC ENVIRONMENTAL SOLUTIONS, INC.

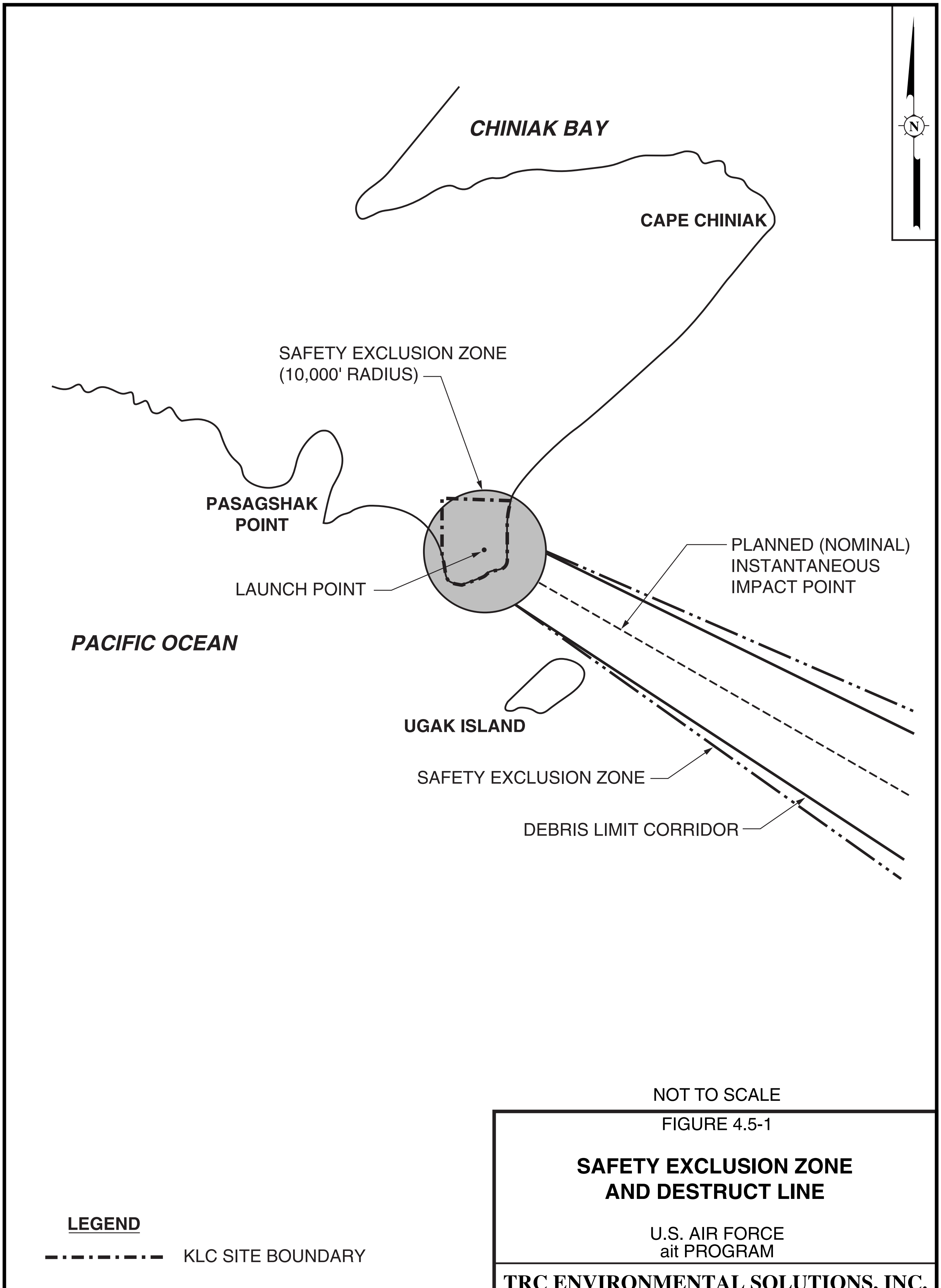


FIGURE 4.5-1

SAFETY EXCLUSION ZONE AND DESTRUCT LINE

U.S. AIR FORCE
ait PROGRAM

TRC ENVIRONMENTAL SOLUTIONS, INC.

APPENDIX A
PUBLIC SCOPING

PUBLIC NOTICE

UNITED STATES AIR FORCE

REQUEST FOR INPUT REGARDING POTENTIAL ENVIRONMENTAL IMPACT OF PROPOSED ROCKET LAUNCHES FROM KODIAK LAUNCH FACILITY

The U.S. Air Force is preparing an Environmental Assessment (EA) to consider and document potential environmental effects resulting from two proposed suborbital rocket launches at the planned Kodiak Launch Complex. The published EA document will be available for public review and comment in October 1997.

To ensure that the EA includes and addresses community concerns via a public scoping process, the Air Force invites all interested parties to submit written comments regarding the potential for environmental impact from these proposed launches.

Interested parties are strongly encouraged to provide comments as soon as possible, so that all appropriate issues can be addressed prior to publication of the EA. Mailed submissions, faxes and e-mails must be sent by September 12, 1997.

For more information or to forward comments for consideration, please contact:

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El Segundo, CA 90245-4659
Fax #: (310) 363-1170
E-mail: Thomas.Huynh@losangeles.af.mil

TABLE A.1

ISSUES RAISED BY THE PUBLIC
USAF *atmospheric interceptor technology (ait)* PROGRAM

NUMBER OF RESPONSES	ENVIRONMENTAL TOPIC
14	Risk to Wildlife and Marine Life
10	Impacts on Fishing Industry
9	Potential Accidents/Safety
5	Lack of Adequate Involvement by the Public
5	Noise/Sonic Booms
4	FAA EA is Inadequate
3	EIS is Required
2	Access to Local Beaches (Fossil Beach and Narrow Cape)
2	Use of Nuclear Materials in Future Rockets
2	Lack of Adequate Road System to Service KLC
2	Ozone Depletion
1	Lack of Comprehensive Demobilization of KLC in EA and Cleanup
	NONENVIRONMENTAL ISSUES RAISED
13	Waste of Taxpayers' Money
2	New Jobs Created for Local Residents

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APPENDIX B
AIR QUALITY

1.0 COMPUTATION OF *ait* SOLID ROCKET MOTOR ATMOSPHERIC EMISSIONS AND DISPERSION

The Joint Army Navy NASA Air Force (JANNAF) Solid Propellant Rocket Motor Performance Prediction Computer Pr Program (SPP), Version 6.0 was used to determine exit plane emissions from each *ait* solid rocket motor. The chemical composition of each *ait* stage is given in Table A-1. The industry standard SPP code models performance and chemistry from the combustion chamber to the nozzle exit plane of solid rocket motors. The chemical composition of the exhaust, determined with the SPP code was input to the Standardized Plume Flowfield Model (SPF3),Version 3.5, to model the post-exit-plane plume through the region of mixing and afterburning to several hundred meters downstream (i.e., the far-field). High temperature reactions which occur in the afterburning region can convert exit plane species to other compounds. For example, HCl is converted to C_l and C_{l2} in this region of the plume. NOx can also be produced in this region from the entrainment of ambient atmospheric species under plume conditions. The extent of afterburning, and thus conversion of species decreases with increasing altitude and eventually shuts down.

The *ait* flight vehicle is comprised of modified versions of the 2nd and 3rd stages of the Minuteman II missile. The model calculations were performed using specifications of the Minuteman II motors (nozzle geometries, operating conditions, propellant compositions, and propellant mass flows) except that the nozzle of the *ait* 1st stage motor (SR-19 Minuteman 2nd stage motor derivative) was taken to have an area expansion ratio of 10:1. The model for the *ait* 2nd stage engine (the M57 Minuteman 3rd stage) employed a single equivalent nozzle for the actual cluster of four nozzles.

Altitudes from the ground up to 40 km were considered (i.e. up through the troposphere and stratosphere). At each altitude, the SPF3 plume model was run for the average thrust level of the appropriate motor (i.e., approximately 52,000 and 18,000 lbf for the 1st and 2nd stage motors respectively) to a distance downstream where afterburning ceased. At that point, the mass flows of relevant species were determined by integrating over a plane perpendicular to the plume axis. The mass flow of each species was then divided by the total mass flow from the motor at the nozzle exit plane. The resulting ratio is the species mass deposition rate relative to the total exit-plane propellant mass flow rate, which in the case of the 1st stage motor is 205 lbm/s at average thrust and in the case of the 2nd stage engine is 65 lbm/s at average thrust. The fractional mass flow for individual species are multiplied by the total mass flow rate to obtain quantities of any species emitted by the nozzle.

The thrust (and mass flow rate) for a solid-fuel rocket motor can be significantly time dependent, varying by as much as +- 20% over the course of the main burn. The modeled relative mass deposition rates, however are not expected to be a strong function of thrust over typical excursions.

1.1 STRATOSPHERIC EMISSIONS

The output of the SPF3 Version 3.5 code was used to determine stratospheric emissions. For the 15 to 40 km altitude region of the stratosphere, quantities of substances deposited (HCl, Cl_2, Cl, Al_2O_3 and NOx) were calculated by integrating the quantity of each species deposited (mass fraction x total mass deposited) over time. The trajectory for the *ait* flights is shown in Figure 4.4-3.

1.2 GROUND-LEVEL EMISSIONS AND DISPERSION

Computer model calculations have been performed to estimate the hazardous chemical concentrations in the air after both normal launches and ground level aborts of the *ait* vehicle from the Kodiak Launch Complex. The primary model used for these calculations is REEDM (Rocket

Exhaust and Effluent Diffusion Model) Version 7.07 (Ref. 6). This model is designed to take into account the fuel and oxidant load, as well as the local meteorology and terrain to predict pollutant concentrations as a function of time and distance after a launch event. The REEDM uses a chemical thermodynamic program (NASA Lewis Chemical Equilibrium CET 89) to estimate such quantities as peak temperature and cloud rise following an abort. For a normal launch, output data from the SPP and SPF3 models on the heat content and chemical composition of a motor plume are input into REEDM.

REEDM was developed originally in 1982 by the H.E. Cramer Company, Inc.; it was based on multilayer dispersion models developed at the NASA Marshall Space Flight Center, and originally intended for the Space Shuttle. It has been used by the Air Force for applications involving Delta, Atlas and Titan launches in the intervening years. REEDM is used by range safety officers as the basis of launch/no-launch determinations at CCAS and VAFB. Several versions have been developed; Version 7.07, used here, was developed by ACTA Inc., in 1995. The REEDM calculations provided here were performed by The Aerospace Corporation, El Segundo, CA.

In order to use REEDM for the current problem, a database needed to be developed for KLC and the *ait* vehicle. The previous EA for the Kodiak Launch Complex, indicated that the terrain feature having the greatest impact on dispersion is a mountain 610 m high, 5 km east of the launchsite. This terrain data base used a 10 degree slope and assumed the remaining terrain was flat.

Figures 1, 2, 3, 4, 5, 6, 7, 8 & -9 show the results of the REEDM predictions for nominal and abort situations for two meteorological cases and two launch dates. For the launch dates scheduled in March and in July, the winds used (from NOAA data for Kodiak) were 5.5 m/s and 3.45 m/s respectively, while the temperatures were 0.5 C and 12.4 C, respectively. A worst case wind, which is nearly calm out of the west was also characterized. An average of 1.75 m/s for the nearly calm winds was used. The worst case occurs 2% of the time throughout the year. The REEDM calculations indicate that HCl, Cl_2, CO, NO and Al_2O_3 are species of potential concern from the *ait* vehicles. However as shown in Fig. 1-9, the peak concentrations and worst case 60 minute exposures for each of these species is far below applicable human exposure standards. These are discussed in Section 4.8 of the *ait* Environmental Assessment.

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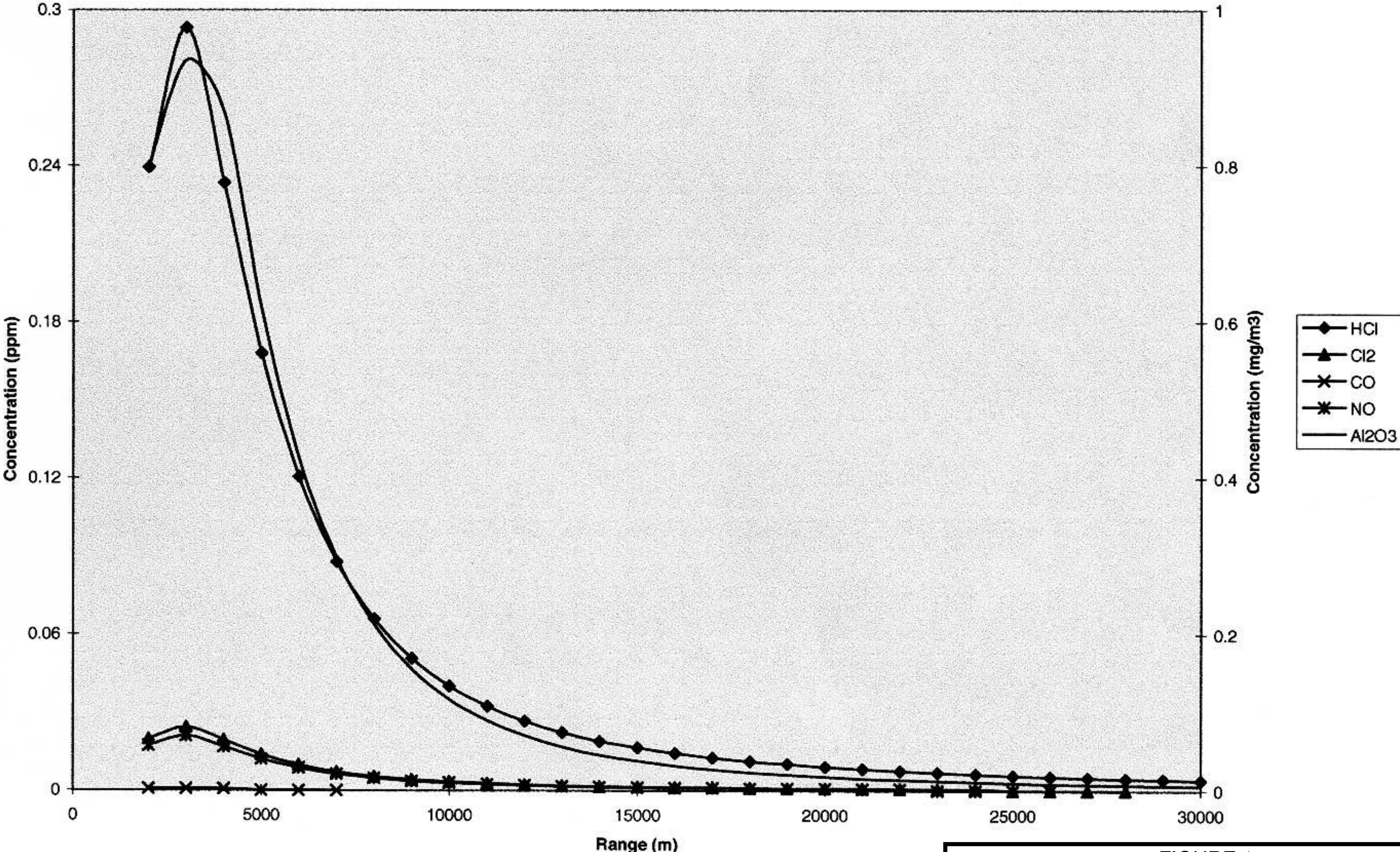

FIGURE 1

DOWNWIND CONCENTRATIONS FROM NORMAL JULY LAUNCH OF AIT, PREVAILING WIND CONDITIONS

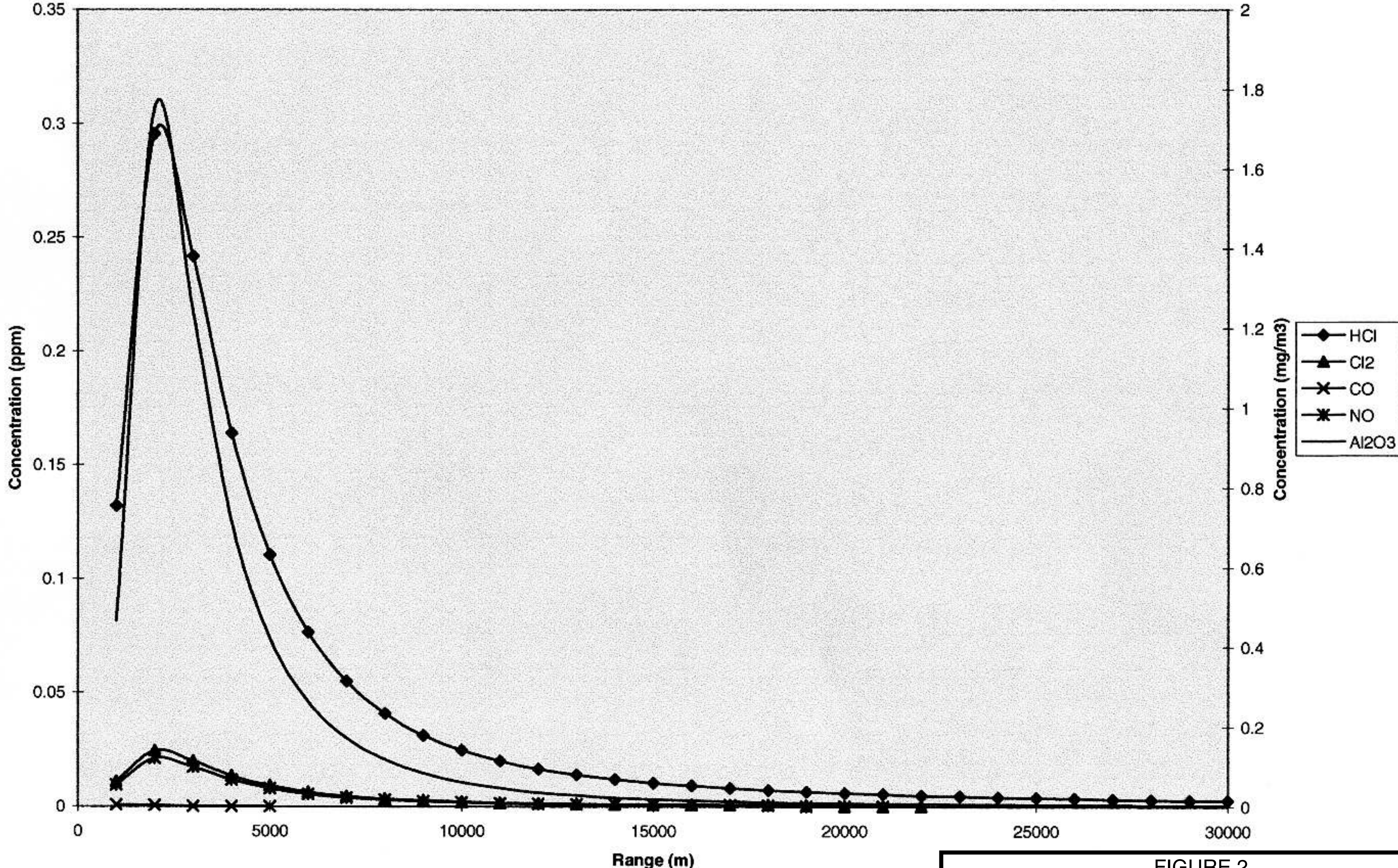

FIGURE 2

DOWNWIND CONCENTRATIONS FROM NORMAL JULY LAUNCH OF AIT, CALM WIND CONDITIONS

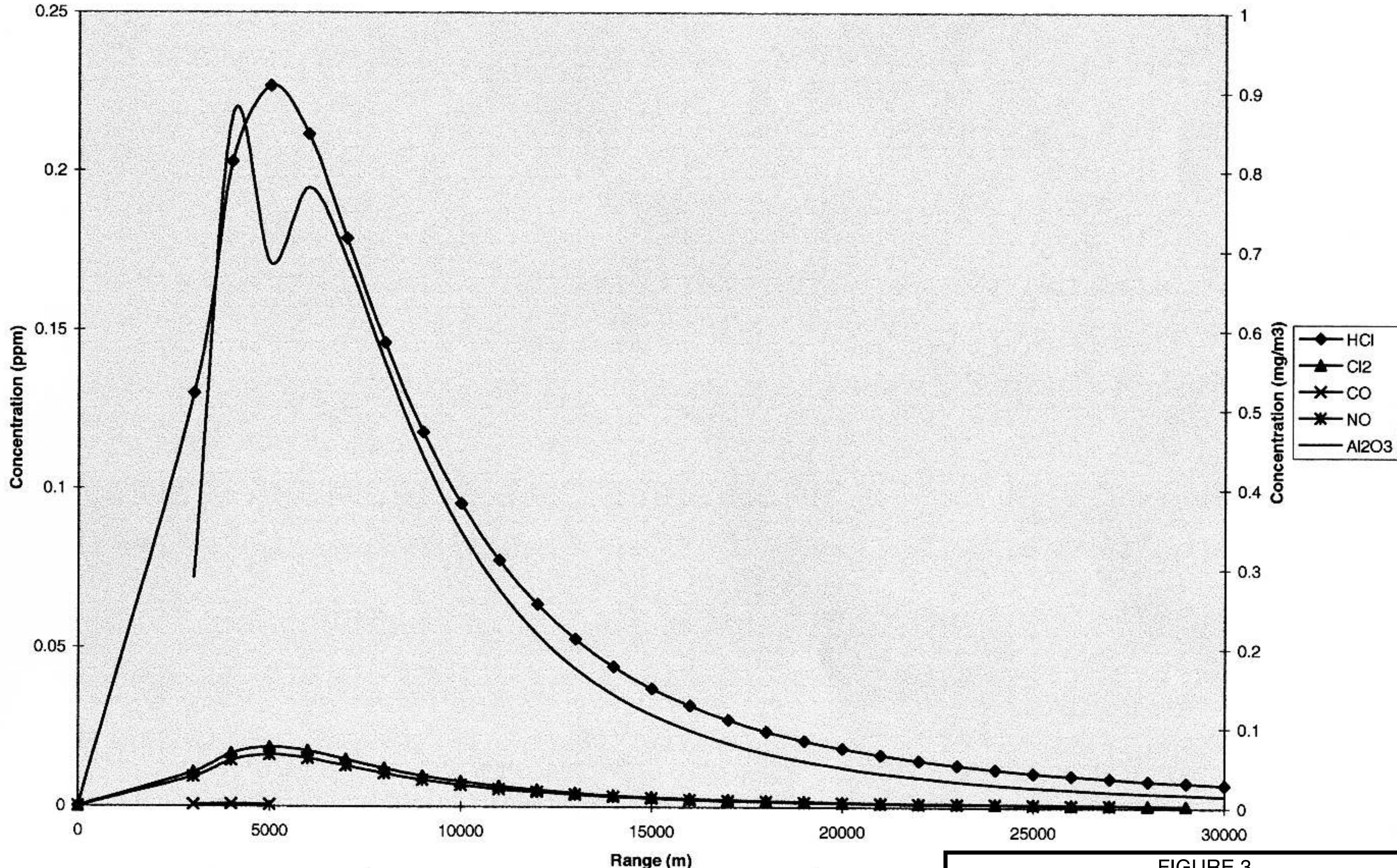

FIGURE 3

DOWNWIND CONCENTRATIONS FROM NORMAL MARCH LAUNCH OF AIT, PREVAILING WIND CONDITIONS

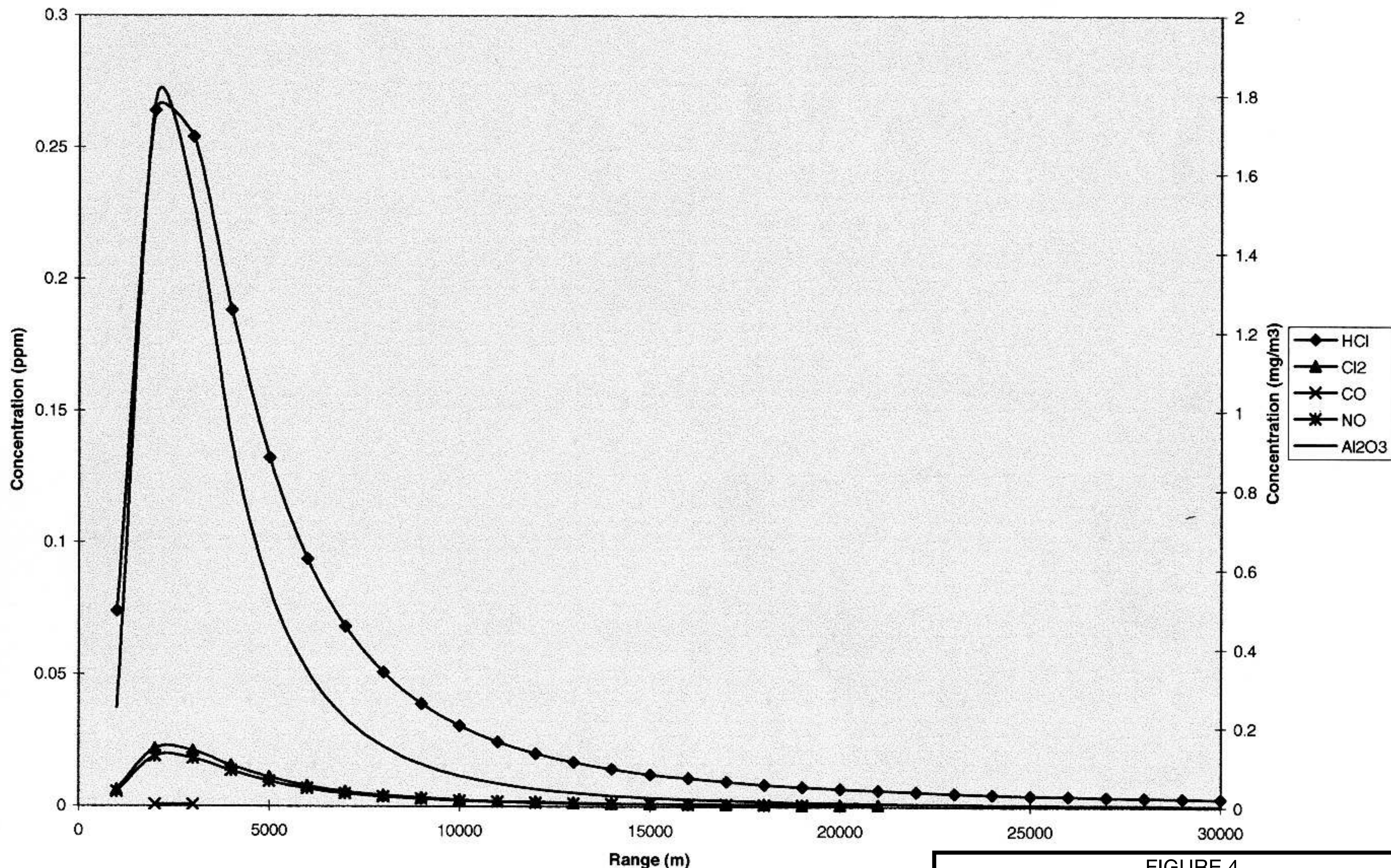

FIGURE 4

DOWNWIND CONCENTRATIONS FROM NORMAL MARCH LAUNCH OF AIT, CALM WIND CONDITIONS

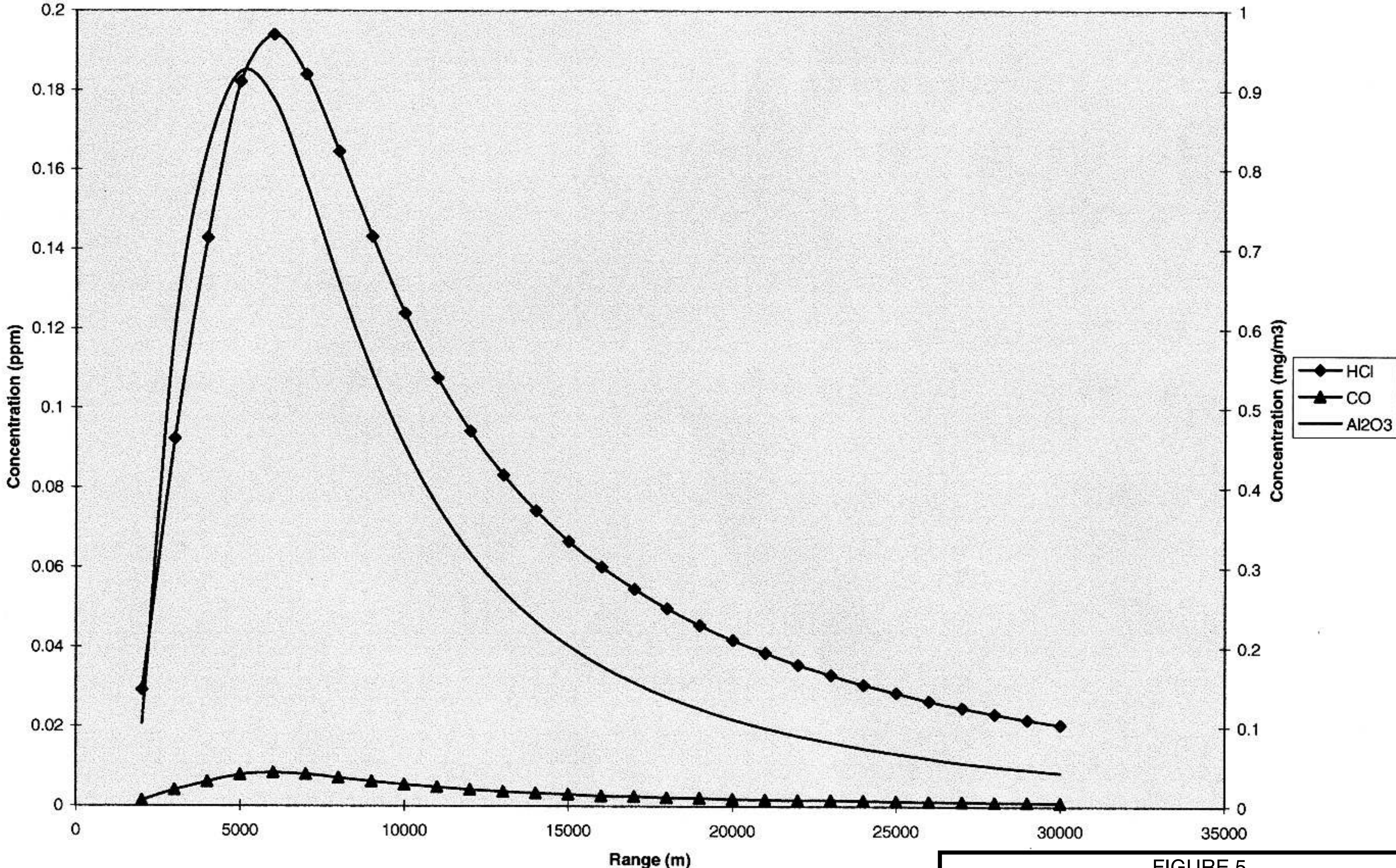

FIGURE 5

DOWNWIND CONCENTRATIONS FROM ABORT OF JULY LAUNCH OF AIT, PREVAILING WIND CONDITIONS

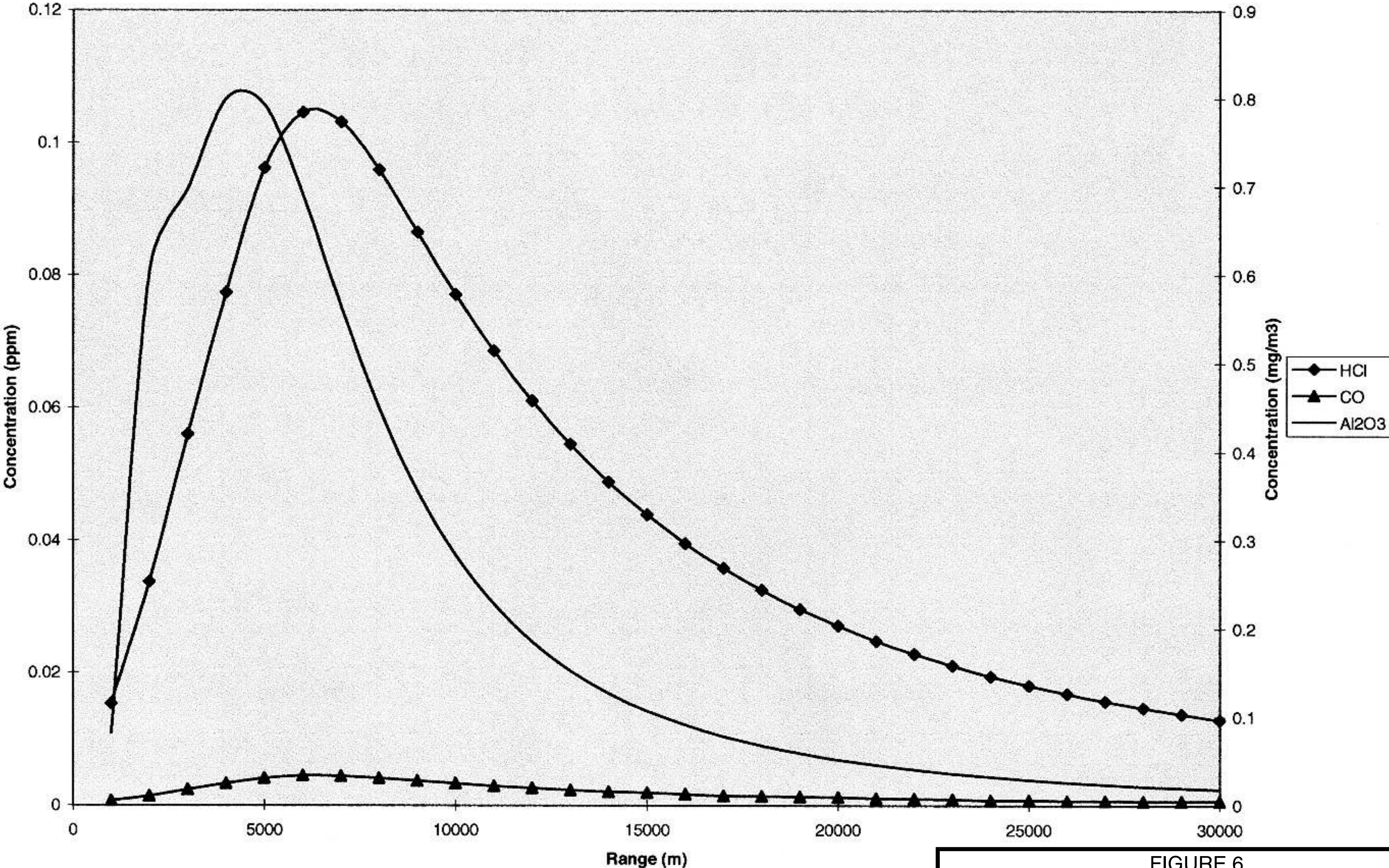

FIGURE 6

DOWNWIND CONCENTRATIONS FROM ABORT OF JULY LAUNCH OF AIT, CALM WIND CONDITIONS

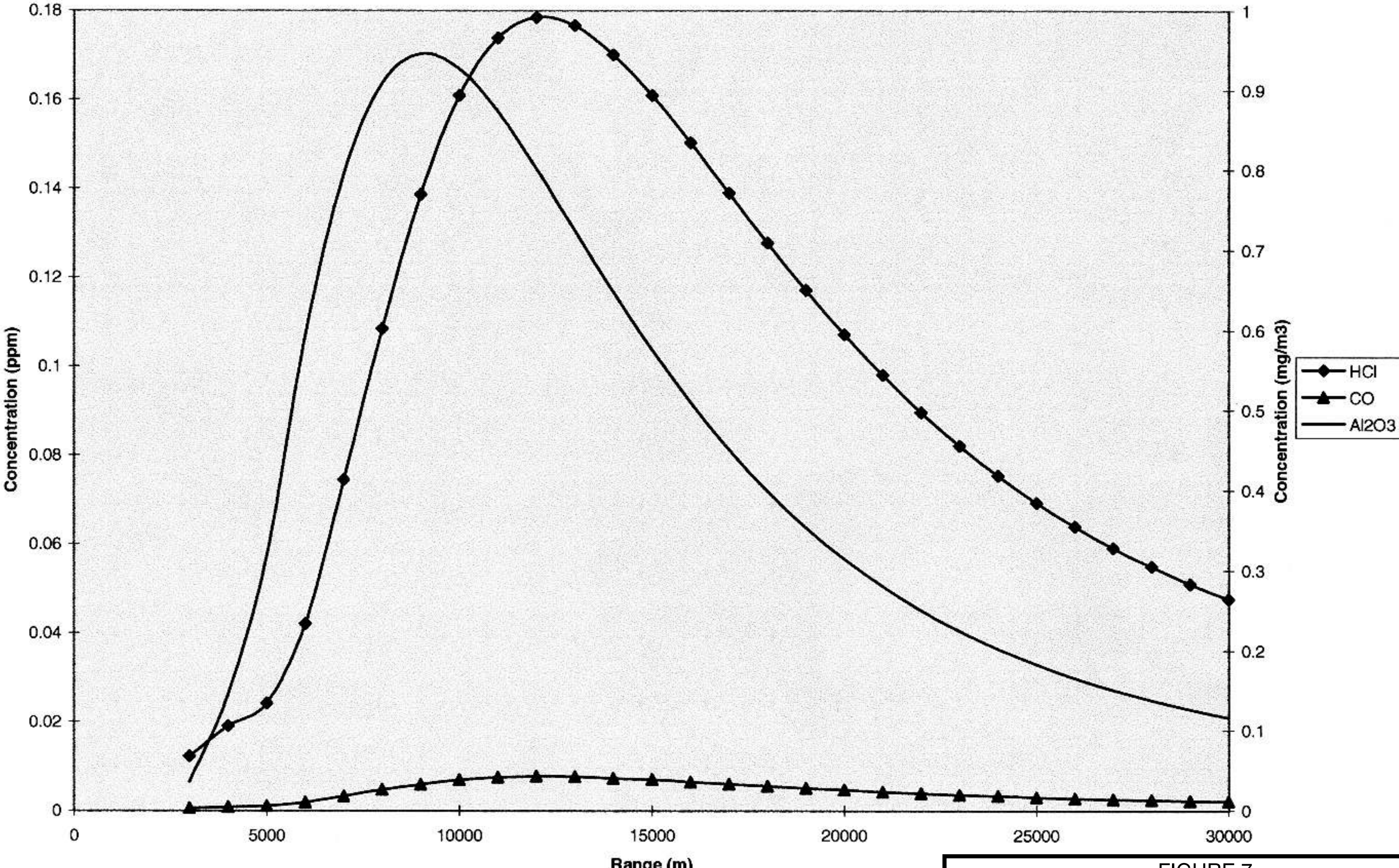

FIGURE 7

DOWNWIND CONCENTRATIONS FROM ABORT OF MARCH LAUNCH OF AIT, PREVAILING WIND CONDITIONS

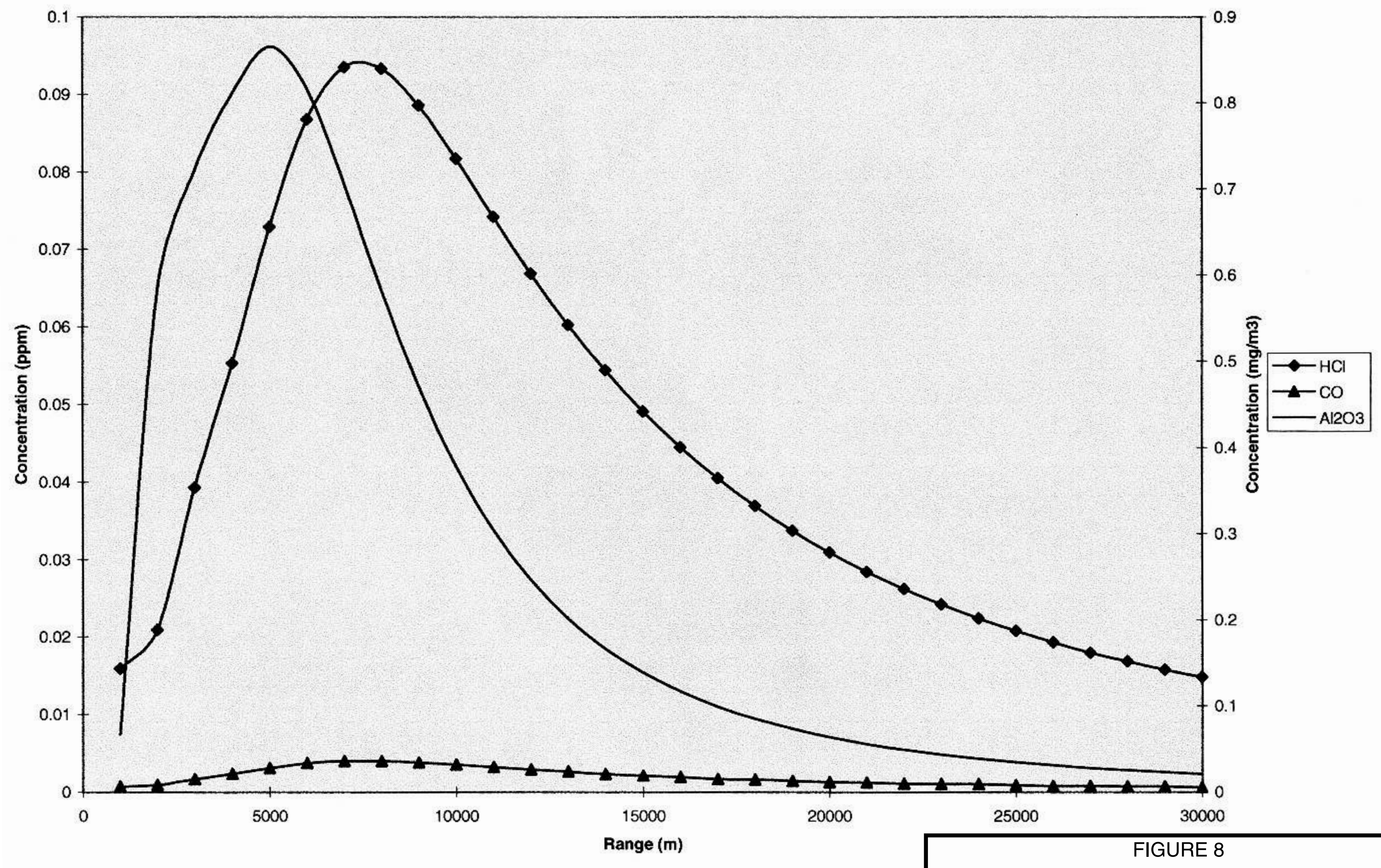

FIGURE 8

DOWNWIND CONCENTRATIONS FROM ABORT OF MARCH LAUNCH OF AIT, CALM WIND CONDITIONS

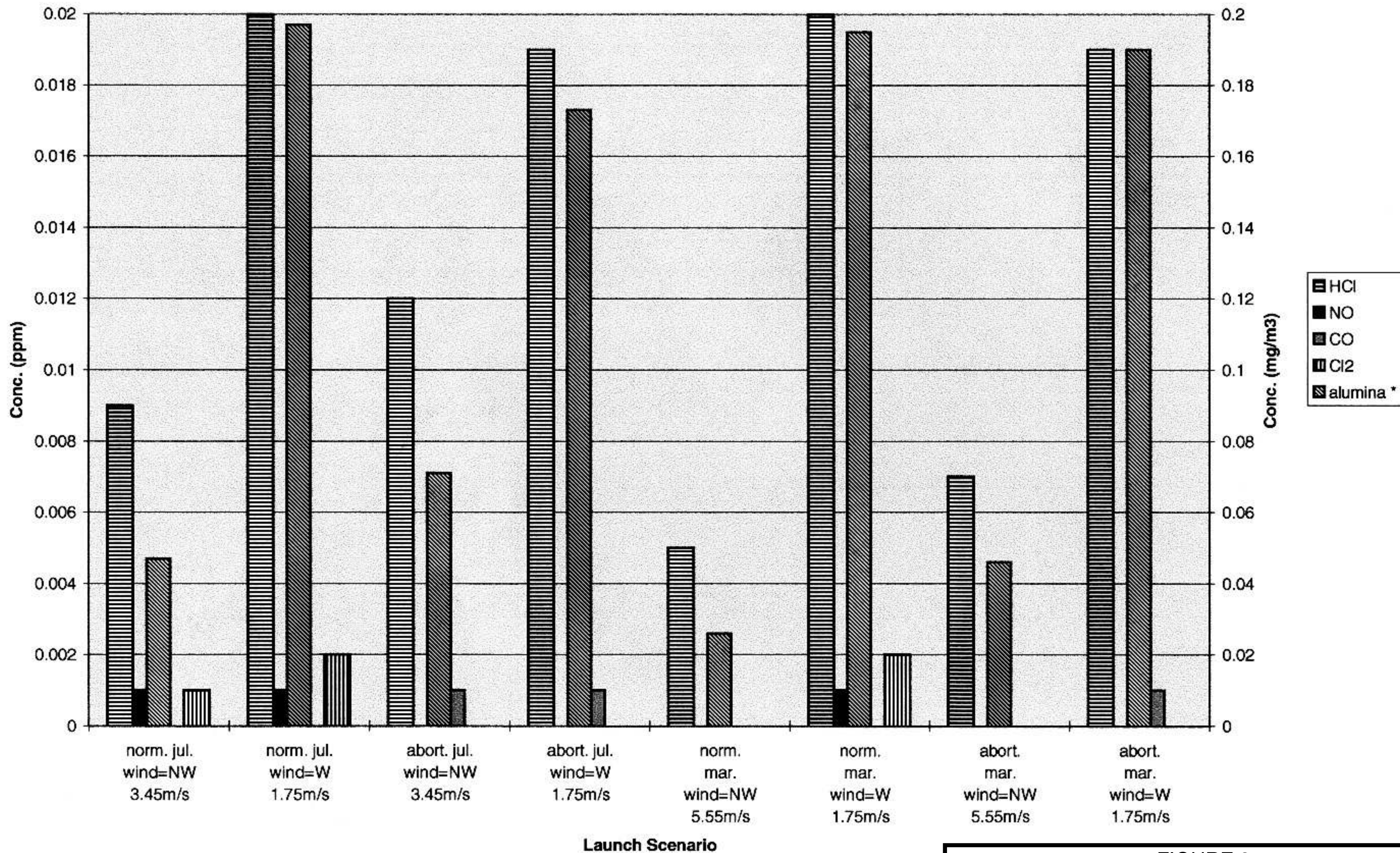

FIGURE 9

MAXIMUM 60 MINUTE MEAN CONCENTRATIONS VS. LAUNCH SCENARIO

APPENDIX C
LAUNCH NOISE AND SONIC BOOM

APPENDIX C: LAUNCH NOISE AND SONIC BOOM

C.1: NOISE METHODS OF ANALYSIS

C.2: RESULTS AND DISCUSSION OF SUBMARINE SONIC BOOM NOISE PENETRATION ANALYSIS

C.3: DESCENT PHASE UNDERWATER IMPACT: FURTHER ANALYSIS

APPENDIX C.1
NOISE METHODS OF ANALYSIS

NOISE METHODS OF ANALYSIS

1.0 NOISE DESCRIPTORS AND EFFECTS

Noise is generally described as unwanted sound. Unwanted sound can be based on objective effects (hearing loss, damage to structures, etc.) or subjective judgments (community annoyance). Noise analysis thus requires a combination of physical measurement of sound with psycho- and socioacoustic effects.

Launch vehicles generate two types of sound. One is engine noise, which is continuous sound. The other is sonic booms, which are transient impulsive sounds. These are quantified in different ways.

1.1 DESCRIPTORS OF CONTINUOUS SOUNDS

Measurement and perception of sound involves two basic physical characteristics: amplitude and frequency. Amplitude is a measure of the strength of the sound and is directly measured in terms of the pressure of a sound wave. Because sound pressure varies in time, various types of pressure averages are usually used. Frequency, commonly perceived as pitch, is the number of times per second the sound causes air molecules to oscillate. Frequency is measured in units of cycles per second, or Hertz (Hz).

Amplitude. The loudest sounds the human ear can comfortably hear have acoustic energy one trillion times the acoustic energy of sounds the ear can barely detect. Because of this vast range, attempts to represent sound amplitude by pressure are generally unwieldy. Sound is therefore usually represented on a logarithmic scale with a unit called the decibel (dB). Sound on the decibel scale is referred to as a sound level. The threshold of human hearing is approximately 0 dB, and the threshold of discomfort or pain is around 120 dB.

The difference in dB between two sounds represents the ratio of those two sounds. Because human senses tend to be proportional (i.e., detect whether one sound is twice as big as another) rather than absolute (i.e., detect whether one sound is a given number of pressure units bigger than another), the decibel scale tends to correlate linearly with human response.

Frequency. The normal human ear can hear frequencies from about 20 Hz to about 15,000 or 20,000 Hz. It is most sensitive to sounds in the 1,000 to 4,000 Hz range. When measuring community response to noise, it is common to adjust the frequency content of the measured sound to correspond to the frequency sensitivity of the human ear. This adjustment is called A-weighting (American National Standards Institute, 1988). Sound levels that have been so adjusted are referred to as A-weighted sound levels. The amplitude of A-weighted sound levels is measured in dB. It is common for some noise analysts to denote the unit of A-weighted sounds by dBA or dB(A). As long as the use of A-weighting is understood, there is no difference between dB, dBA or dB(A). It is only important that the use of A-weighting be made clear. It is common to use the term A-weighted sound pressure level (AWSPL) to refer to A-weighted sounds.

For analysis of damage to structures by sound, it is common not to apply any frequency weighting. Such overall sound levels are measured in dB and are often referred to as overall sound pressure levels (OASPL or OSPL).

C-weighting (American National Standards Institute, 1988) is sometimes applied to sound. This is a frequency weighting that is flat over the range of human hearing (about 20 Hz to 20,000 Hz) and rolls off above and below that range. C-weighted sound levels are often used for analysis of high-amplitude impulsive noise, where adverse impact is influenced by rattle of buildings.

Time Averaging. Sound pressure of a continuous sound varies greatly with time, so it is customary to deal with sound levels that represent averages over time. Levels presented as instantaneous (i.e., as might be read from the dial of a sound level meter), are based on averages of sound energy over either 1/8 second (fast) or one second (slow). The formal definitions of fast and slow levels are somewhat complex, with details that are important to the makers and users of instrumentation. They may, however, be thought of as levels corresponding to the root-mean-square sound pressure measured over the 1/8-second or 1-second periods.

The most common uses of the fast or slow sound level in environmental analysis is in the discussion of the maximum sound level that occurs from the action, and in discussions of typical sound levels. Figure A-1 is a chart of sound levels from typical sounds.

Assessment of cumulative noise impact requires average levels over periods longer than just the fast or slow times. The sound exposure level (SEL) sums the total sound energy over a noise event. Mathematically, the mean square sound pressure is computed over the duration of the event, then multiplied by the duration in seconds, and the resultant product is turned into a sound level. SEL is sometimes described as the level which, occurring for one second, would have the same sound energy as the actual event.

Note that SEL is a composite metric that combines both the amplitude of a sound and its duration. It is a better measure of noise impact than the maximum sound level alone, since it accounts for duration. Long sounds are more intrusive than short sounds of equal level, and it has been well established that SEL provides a good measure of this effect.

SEL can be computed for A- or C-weighted levels, and the results denoted ASEL or CSEL. It can also be computed for unweighted (overall) sound levels, with a corresponding designation.

For longer periods of time, total sound is represented by the equivalent continuous sound pressure level (L_{eq}). L_{eq} is the average sound level over some time period (often an hour or a day, but any explicit time span can be specified), with the averaging being done on the same energy basis as used for SEL. SEL and L_{eq} are closely related, differing by (a) whether they are applied over a specific time period or over an event, and (b) whether the duration of the event is included or divided out.

Just as SEL has proven to be a good measure of the noise impact of a single event, L_{eq} has been established to be a good measure of the impact of a series of events during a given time period. Also, while L_{eq} is defined as an average, it is effectively a sum over that time period and is thus a measure of the cumulative impact of noise.

Noise tends to be more intrusive at night than during the day. This effect is accounted for by applying a 10-dB penalty to events that occur after 10 PM and before 7 AM. If L_{eq} is computed over a 24-hour period with this nighttime penalty applied, the result is the day-night average sound level (L_{dn} or DNL). L_{dn} is the community noise metric recommended by the U.S. Environmental Protection Agency (U.S. Environmental Protection Agency, 1972) and has been adopted by most federal agencies (Federal Interagency Committee on Noise, 1992). It has been well established that L_{dn} correlates well with community response to noise (Schultz, 1978; Finegold et al., 1994).

The state of California quantifies noise by Community Noise Exposure Level (CNEL). This metric is similar to L_{dn} except that a penalty of 5 dB is applied to sounds in the evening, after 7:00 p.m. and before 10:00 p.m.

It was noted earlier that, for impulsive sounds, C-weighting is more appropriate than A-weighting. The day-night average sound level can be computed for C-weighted noise, and is denoted L_{Cdn} or CDNL. This procedure has been standardized, and impact interpretive criteria similar to those for L_{dn} have been developed (CHABA, 1981).

1.2 DESCRIPTORS OF SONIC BOOMS

Figure A-2 shows time histories (pressure versus time) for the two types of sonic boom signatures generated by launch vehicles: N-wave carpet booms and U-wave focus booms. Each consists of a pair of shock waves connected by a linear expansion (N-wave) or a U-shaped curve (U-wave). Each type of boom is well described by its peak overpressure in pounds per square foot (psf), and its duration in milliseconds (msec). Duration tends to have a minor effect on impact, so the peak pressure is all that is normally required.

For assessment of impact via L_{Cdn} as discussed in Section 1.0, the peak pressure is related in a simple way to CSEL, from which L_{Cdn} can be constructed. The peak pressure P (psf) is converted to the peak level (L_{pk}) dB by the relation

$$L_{pk} = 127.6 + 20 \log_{10} P \qquad \text{(A-1)}$$

CSEL is then given by Plotkin (1993):

$$CSEL = L_{pk} - 26 \qquad \text{(N-wave)} \qquad \text{(A-2)}$$

$$CSEL = L_{pk} - 29 \qquad \text{(U-wave)} \qquad \text{(A-3)}$$

2.0 NOISE EFFECTS

2.1 ANNOYANCE

Studies of community annoyance to numerous types of environmental noise show that L_{dn} is the best measure of impact. Schultz (1978) showed a consistent relationship between L_{dn} and annoyance. This relationship, referred to as the “Schultz curve”, has been reaffirmed and updated over the years (Fidell et al., 1991; Finegold et al., 1994). Figure A-3 shows the current version of the Schultz curve.

Some time ago L_{dn} of 55 dB or less had been identified as a threshold below which adverse impacts to noise are not expected (U.S. Environmental Protection Agency, 1972). It can be seen from Figure A-3 that this is a region where a small percentage of people are highly annoyed. L_{dn} of 65 dB is widely accepted as a level above which some adverse impact should be expected (Federal Interagency Committee on Noise, 1992), and it is seen from Figure A-3 that about 15 percent of people are highly annoyed at that level.

A limitation of the Schultz curve is that it is based on long-term exposure to noise. The proposed action is for a single launch. Therefore, analysis in the current study examines this on a single-event basis.

2.2 SPEECH INTERFERENCE

Conversational speech is in the 60 to 65 dB range, and interference with this can occur when noise enters or exceeds this range. Speech interference is one of the primary causes of annoyance. The Schultz curve incorporates the aggregate effect of speech interference on noise impact.

Because only two launches are planned, and noise would last for only a few minutes, speech interference is not expected to be a significant impact.

2.3 SLEEP INTERFERENCE

Sleep interference is commonly believed to be a significant noise impact. The 10-dB nighttime penalty in L_{dn} is based primarily on sleep interference. Recent studies, however, show that sleep interference is much less than had been previously believed (Pearsons et al., 1989; Ollerhead, 1992).

Traditional studies of sleep disturbance indicate that interference can occur at levels as low as 45 dB. Data indicates that at indoor SEL of 70 dB, about 20 percent of people will awaken (Federal Interagency Committee on Noise, 1992). Assuming a nominal outdoor-to-indoor noise reduction of 20 dB, these correspond to outdoor sound exposure levels of 65 dB and 90 dB, respectively. Note that the awakening threshold is comparable to the threshold of outdoor speech interference.

2.4 TASK INTERFERENCE

Due to startle effects, some task interference may occur to sonic booms. High levels of rocket noise may cause some task interference close to the launch sites. It is difficult to estimate degrees of task interference, since this is highly dependent on specific tasks. Startle from sonic booms is often stated as a concern, but there are no credible reported incidents of harm from sonic boom startle. Task interference from rocket noise is expected to occur at higher levels than speech interference.

2.5 HEARING LOSS

Federal OSHA guidelines (Title 29 CFR 1910.95) specify maximum noise levels to which workers may be exposed on a regular basis without hearing protection. Pertinent limits are a maximum of 115 dBA for up to 15 minutes per day, and unweighted impulsive noise of up to 140 dB. Exceeding these levels on a daily basis over a working career is likely to lead to hearing impairment. These levels are conservative for evaluating potential adverse effects from occasional noise events.

2.6 HEALTH

Nonauditory effects of long-term noise exposure, where noise may act as a risk factor, have never been found at levels below federal guidelines to protect against hearing loss. Most studies attempting to clarify such health effects found that noise exposure levels established for hearing protection will also protect against nonauditory health effects (von Gierke, 1990). There are some studies in the literature that claim adverse effects at lower levels, but these results have generally not been reproducible.

2.7 STRUCTURES

2.7.1 Launch Noise

Damage to buildings and structures from noise is generally caused by low-frequency sounds. The probability of structural damage claims has been found to be proportional to the intensity of the low-frequency sound. Damage claim experience (Guest and Sloane, 1972) suggests one claim in 10,000 households is expected at a level of 103 dB, one in 1,000 households at 111 dB, and one in 100 households at 119 dB.

Figure A-4 shows criteria for damage to residential structures (Sutherland, 1968), and compares them to launch noise spectra that could occur a few kilometers from the launch point of a medium (300,000 to 500,000 pound thrust) rocket. These data show that noise-induced damage to off-base property would typically be very minimal.

2.7.2 Sonic Boom

Sonic booms are commonly associated with structural damage. Most damage claims are for brittle objects, such as glass and plaster. Table A-1 summarizes the threshold of damage that might be expected at various overpressures. There is a large degree of variability in damage experience, and much damage depends on the pre-existing condition of a structure. Breakage data for glass, for example, spans a range of two to three orders of magnitude at a given overpressure. While glass can suffer damage at low overpressures, as shown in Table A-1, laboratory tests glass (White, 1972) have shown that-properly installed window glass will not break at overpressure below 10 psf, even when subjected to repeated booms.

The maximum sonic boom overpressures for the proposed launch will be 2.7 psf during launch (maximum focus boom) and 3.2 psf during entry, near the water impact point. These are well below the threshold where structural damage would be expected, were there structures in the vicinity.

3.0 NOISE MODELING

3.1 LAUNCH NOISE

On-pad and in-flight rocket noise was computed using the RNOISE model (Plotkin et al., 1997). Rocket noise prediction via this model consists of the following elements:

1. The total sound power output, spectral content and directivity is based on the in-flight noise model of Sutherland (1993). Noise emission is a function of thrust, nozzle exit gas velocity, nozzle exit diameter, and exhaust gas properties.

2. Propagation from the vehicle to the ground accounts for Doppler shift, absorption of sound by the atmosphere (American National Standards Institute, 1978), inverse square law spreading, and attenuation of sound by the ground (Chien and Soroka, 1980). A semi-hard ground surface (1,000 mks rayls) was assumed.

3. One-third spectral levels were computed at the ground, for every flight trajectory point, on a grid of 3721 points. ASEL and maximum A-weighted and overall sound levels were then derived from the results at each grid point.

The computed noise levels were then depicted as contours of equal level.

3.2 SONIC BOOM

Sonic boom was computed using the U.S. Air Force's PCBoom3 software (Plotkin, 1996). This is a full ray tracing model. Details of sonic boom theory are presented by Plotkin (1989) and Maglieri and Plotkin (1991). The specific approach to sonic boom modeling included the following elements:

1. Trajectories provided by the vehicle manufacturers were converted into PCBoom3 TRJ format using PCBoom3's TRAJ2TRJ utility. This utility generated required higher derivatives, as well as converting file formats.

2. Vehicle F-functions were calculated using the method of Carlson (1978). Area distributions were obtained from vehicle drawings. The shape factors computed were used to obtain nominal N-wave F-functions.

3. The F-function associated with the plume was obtained by a combination of the Universal Plume Model (Jarvinen and Hill, 1970) and Tiegerman's (1975) hypersonic boom theory.

4. Ray tracing and signature evolution were computed by integration of the eiconal and Thomas's (1972) wave parameter method.

5. Focal zones were detected from the ray geometry, and focus signatures computed by applying Gill and Seebass's (1975) numerical solution.

The resultant sonic boom calculations were depicted as contours of constant overpressure (psf).

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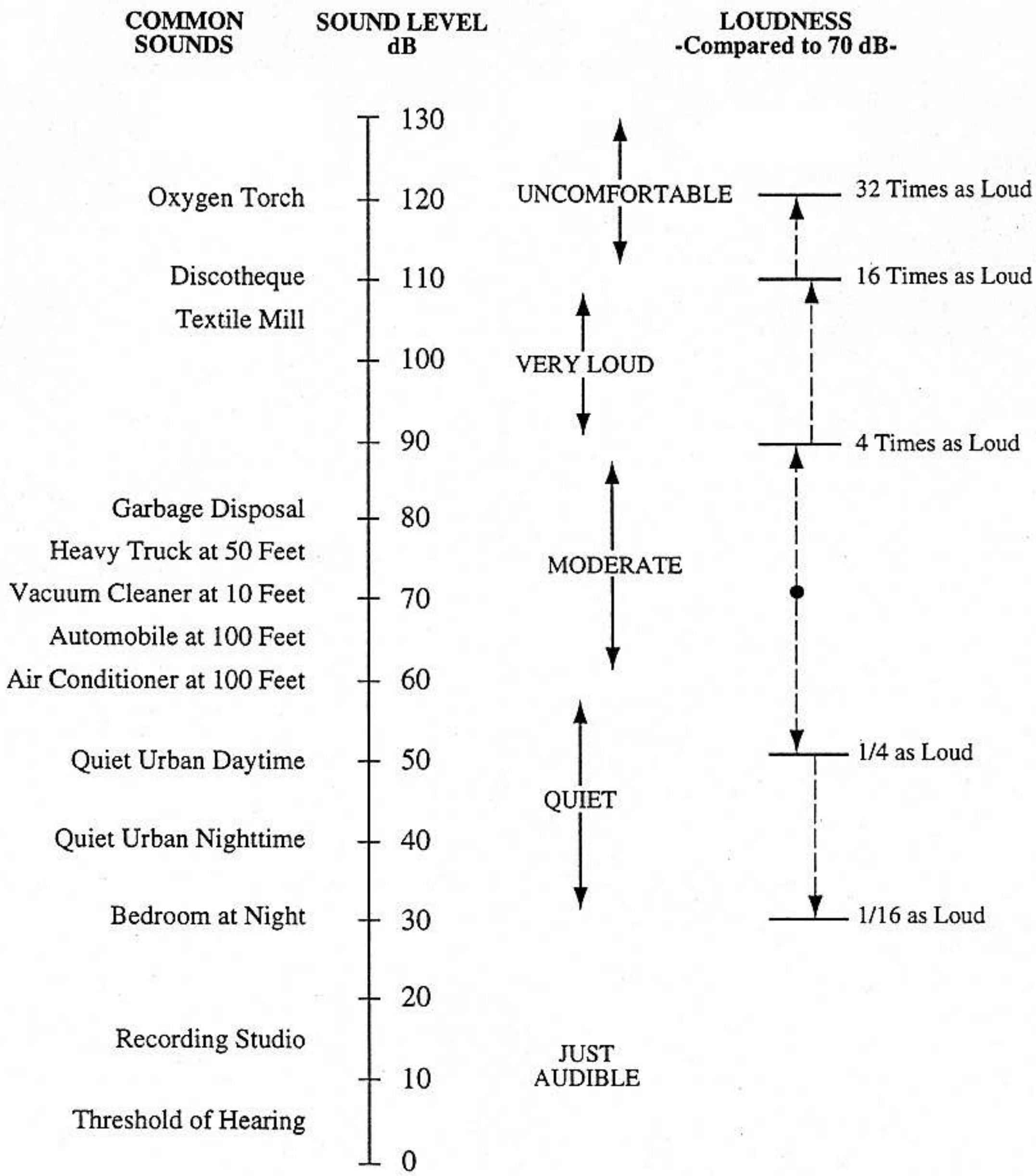
Table A-1. Possible Damage to Structures From Sonic Booms

Sonic Boom Overpressure Nominal (psf)	Type of Damage	Item Affected
0.5 - 2	Cracks in plaster	Fine; extension of existing; more in ceilings; over door frames; between some plaster boards.
	Cracks in glass	Rarely shattered; either partial or extension of existing.
	Damage to roof	Slippage of existing loose tiles/slates; sometimes new cracking of old slates at nail hole.
	Damage to outside walls	Existing cracks in stucco extended.
	Bric-a-brac	Those carefully balanced or on edges can fall; fine glass, e.g., large goblets, can fall and break.
	Other	Dust falls in chimneys.
2 - 4	Glass, plaster, roofs, ceilings	Failures show that would have been difficult to forecast in terms of their existing localized condition. Nominally in good condition.
4 - 10	Glass	Regular failures within a population of well-installed glass; industrial as well as domestic greenhouses.
	Plaster	Partial ceiling collapse of good plaster; complete collapse of very new, incompletely cured, or very old plaster.
	Roofs	High probability rate of failure in nominally good state, slurry-wash; some chance of failures in tiles on modern roofs; light roofs (bungalow) or large area can move bodily.
	Walls (out)	Old, free standing, in fairly good condition can collapse.
	Walls (in)	Inside ("Party") walls known to move at 10 psf.
Greater than 10	Glass	Some good glass will fail regularly to sonic booms from the same direction. Glass with existing faults could shatter and fly. Large window frames move.
	Plaster	Most plaster affected.
	Ceilings	Plaster boards displaced by nail popping.
	Roofs	Most slate/slurry roofs affected, some badly; large roofs having good tile can be affected; some roofs bodily displaced causing gale-end and will-plate cracks; domestic chimneys dislodged if not in good condition.
	Walls	Internal party walls can move even if carrying fittings such as hand basins or taps; secondary damage due to water leakage.
	Bric-a-brac	Some nominally secure items can fall; e.g., large pictures, especially if fixed to party walls.

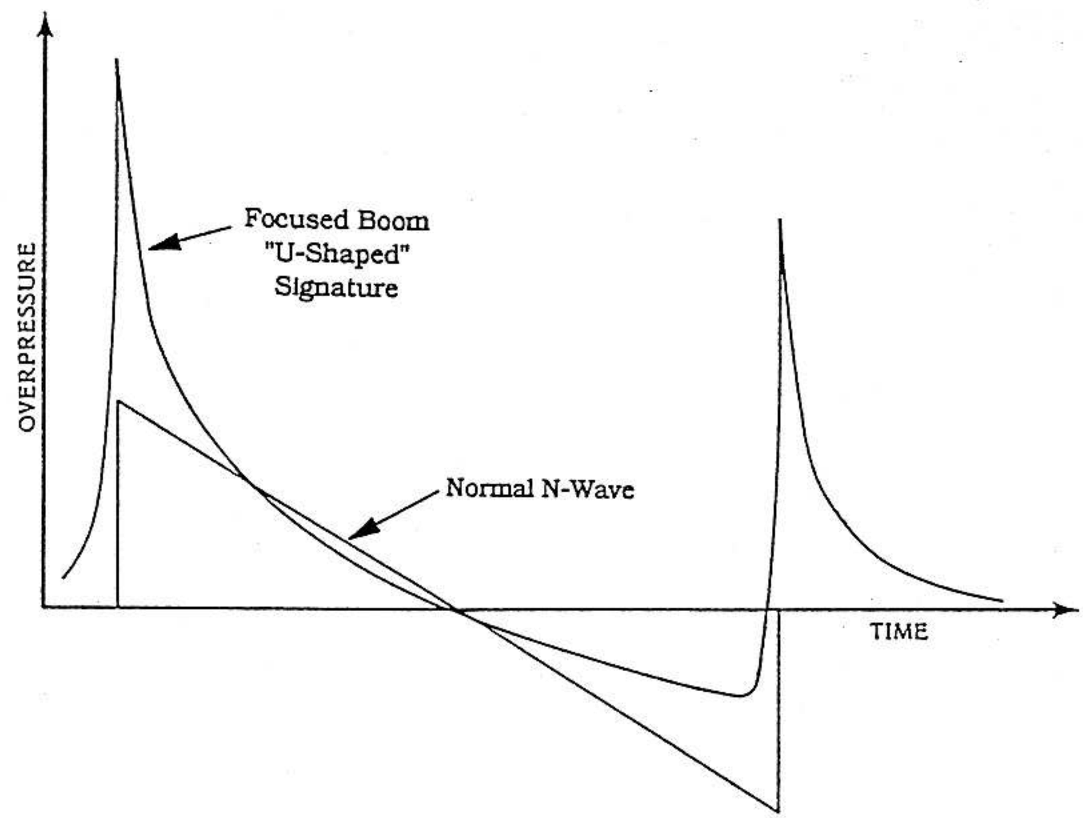
Source: Haber and Nakaki, 1989



A-Weighted Sound Levels of Common Sounds

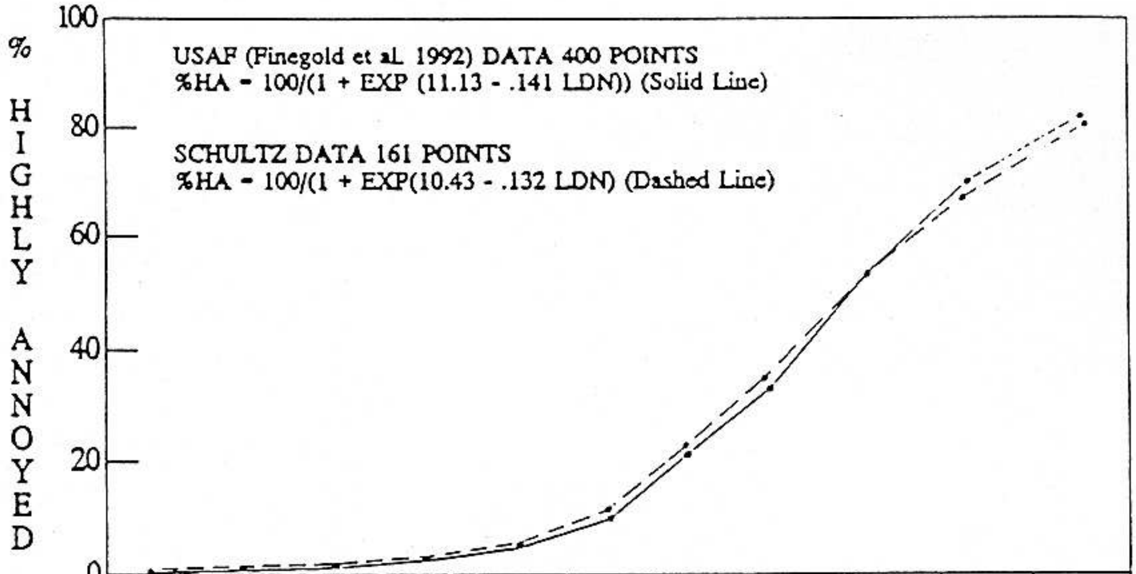
Figure A-1

Source: Handbook of Noise Control, C.M. Harris, Editor, McGraw-Hill Book Co., 1979.



Focused U-Wave and Unfocused N-Wave Boom Signatures

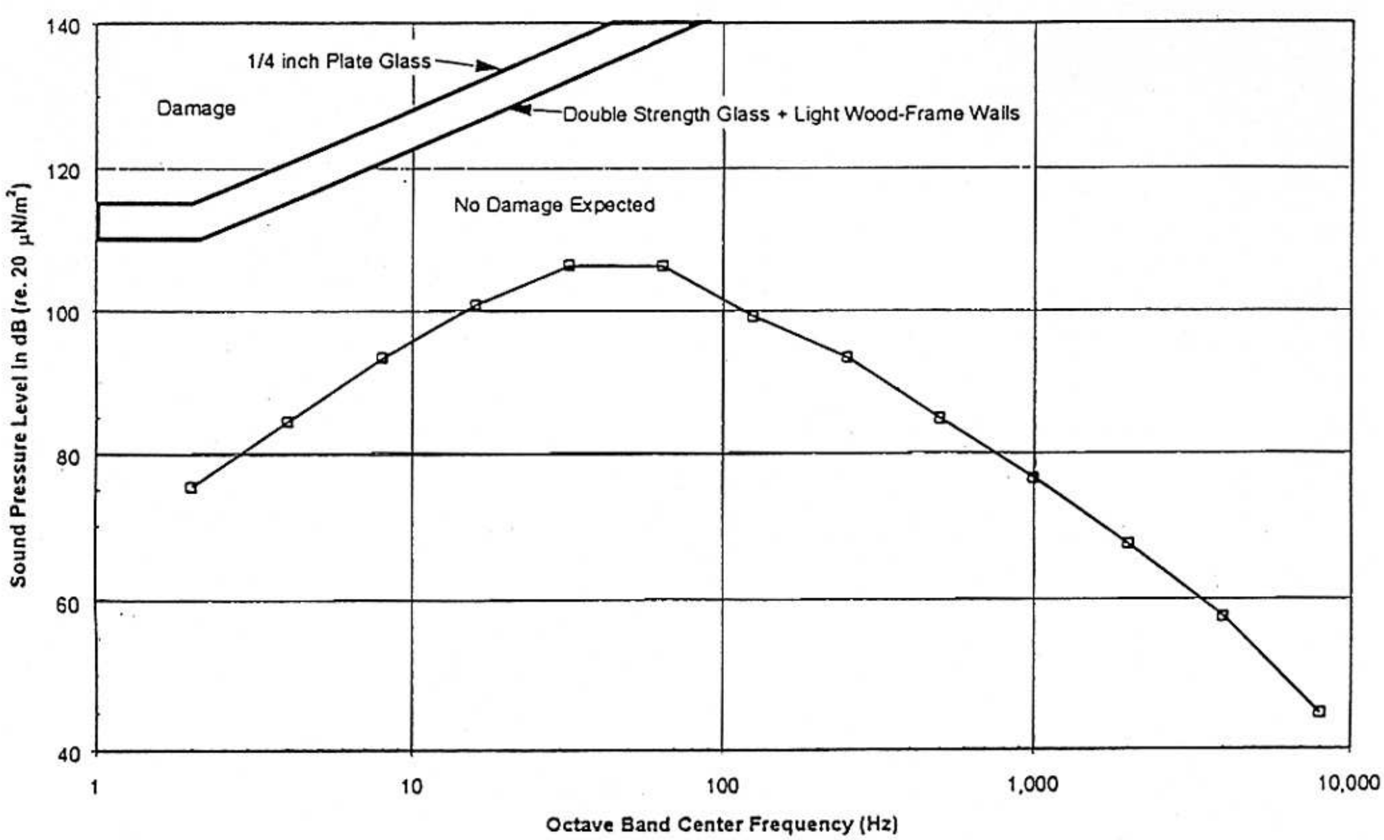
Figure A-2



Day - Night Average Sound Level in dB		40	45	50	55	60	65	70	75	80	85	90
Calculated %HA Points	USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
	SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

Community Response to Noise

Figure A-3



Criteria for Noise Damage to Residential Structures and Typical Off-Base Launch Noise Spectrum

Figure A-4

APPENDIX C.2
RESULTS AND DISCUSSION OF SUBMARINE SONIC BOOM NOISE PENETRATION ANALYSIS

Results and Discussion of Submarine Sonic Boom Noise Penetration Analysis

Remarks on input data and model analysis

The input data in the analysis for the Kodiak program, was furnished by Dr. K. Plotkin, Wyle laboratory, based on scaling laws deduced from an earlier work by Jarviner and Hill [1] for underexpanded rocket plumes. The shape of the exhaust plume was determined up to a downstream station where the Mach disc is located. Together with the known vehicle geometry, this suffices to arrive at the F-function needed for the ray/geometrical acoustic calculation, from which the incident waveform and intensity at the sea level were obtained. Figure 1 illustrates schematically the plume and the Mach disc downstream of the rocket and the corresponding F-function distribution. The overpressure data at the sea level contributed by the omitted plume portion was not available.

Although the contribution from the rear portion of the plume is relatively weak and has little significance for most predictions/measurements on the ground, its effects on noise penetration under water may not be negligible, inasmuch as the plume can not only add considerably to the signature length, of the waveform, say L', but may alter the far-field attenuation rate (owing to an unbalanced [total] impulse which is normally zero). Therefore, in addition to the analysis made according to the two sets of sea-level overpressure furnished, three more sets of sea-level overpressure will be considered in order to access the correct real-plume effects.

While the plume effect should generally be regarded a significant aspect of the submarine problem for most space-launch program, the Kodiak program at hand may be expected as an exception. This is because the smallness of the rocket's weight, thrust, and dimension make its hydroacoustic impact very minute in comparison with that found with the Apollo or Atlas launch (which we have examined earlier). (The rocket thrust delivered at the Minute-Man launch amounts only to about 1% of that for the Apollo.)

The sound-pressure intensity underwater at the level of 160 db has been considered potentially harmful to some marine mammal species [2,3].* This would amount to about two (2) psf.** On the other hand, intensity at the 120-130 db corresponding to (rms) overpressure in the percentile (0.01) psf range, may also affect adversely the behavior and activity patterns of some fish and mammals. These are believed to be factors in the recent impact assessment on the program of ocean wave guide (SOFAR) experiments [3,4,5]. Whereas, the following model analyses will confirm that the sonic-boom noise generated in the present program cannot reach well down to the 1 km depth of the SOFAR channel, an overpressure level at the 0.01-2 psf range does occur at depth of 0-100 meters, according to the following analysis.

In passing, we note that the 10^{-2} psf level mentioned and to be seen below is still well above the 10^{-1} Pa, or 0.0021 psf, which has been taken to be the back-ground noise level of the sea in many studies, according to Ref [6]. Also note that acoustic disturbances in the 10-500 Hz frequency range, as well as in the higher 10-30 kHz have been of concern in studies with certain whale species [7].*** The acoustic signals in the higher range mentioned was of considered essential in previous investigations, on account of their relatively short propagation range, being 10 km or

* Presumably, it causes a prolonged period of the hearing-threshold shift.

** "psf" stands for pounds per square foot.

*** The 10-500 Hz signals are believed to affect mostly Baleen whales, while the 10-30 kHz may potentially affect the smaller mammal species. I am grateful to Dr. Bruce Howe, Wash. Univ., Seattle, Wash. for helpful discussions.

less, owing to a chemical absorption process according to an existing study [7]. But this 10 km range is by no means short for noise penetration study here.

The results discussed below pertain mainly to the analysis based on the *flat-ocean* model, in which the critical dependence on the rocket-size and its plume effects will become clearly evident. The two sets of the available sea-level overpressure data are limited however to a condition corresponding to a wavefield moving over the (ocean) surface at nearly the *sonic* speed which is comparable to that in a superboom. Under this condition, a solution allowing interaction with a wavy (ground/ocean) surface is yet to be developed. For this reason, the corresponding wavefield computations *under* a wavy ocean has not been performed. As indicated in an earlier elucidation, this interaction effects will be significant even for incident waves corresponding to a "carpet boom" normally found in steady supersonic cruise. Its importance will nevertheless be discussed on the basis of an example analyzed earlier at a condition removed from that of a super/focused boom.

Submarine Sonic-Boom Wavefields Under a Flat Ocean

Two incident sonic-boom wave forms at the sea level furnished by the Wyle Laboratory, together with three of their variants, are employed as input surface overpressure data for calculating five cases of hydroacoustic response in a flat-ocean model. The sea-level overpressure in the first example was obtained (directly) from the geometrical acoustic calculation of the PC Boom program, referred to as the "carpet boom." Its distribution is shown as solid curve at the top left of Fig. 2 for z=o corresponding to the sea level. Inspite of the presence of *three* discontinuities in the F-function [Fig.1(b)], the waveform arriving at the sea level takes on nearly N-wave form. The example with this input waveform will be designated to be Case A. For the second example, to be referred as Case B, the incident waveform at the sea level was provided by another version of the PC Boom involving a *local* modification of the geometrical acoustic program by adopting partly the Gill-Seebass model solution to the Tricomi equation. This is the "focal-boom model" proposed and implemented successfully by Plotkin in Ref. [8]. The resulting overpressure at the sea level is shown in dashes also on the top left of Fig. 2 for Z = 0. The rabbit-ear like spikes near the two ends of the profile in dashes has been known to be characteristic of waveform from the Gill-Seebass model as well as several sonic-boom measurements recorded from towers (above the ground level). The overpressure at each streamwise location are shown as "dP" (in psf) vs. "x" (in feet) at six successive depth levels in Fig. 2, corresponding to distances from the surface Z = 0, 10, 50, 100, 300 and 1,000 feet. Both set of results show that the disturbance magnitude as well as its manner of attenuation are not much different from those found in submarine response to aircraft-generated sonic booms [9,10].

We next examine the importance of, and the need for, a more complete description of the F- function corresponding to the aft portion of the rocket plume. We consider three plume extension models, postulating in two of these cases the similarity between the anticipated Kodiak/Minute-Man waveform and that of the much larger Apollo/Atlas system in the length scales of the negative to positive portions of the waveform (at sea level). The latter scale ratio is found to be approximately nine to one (9:1) [11]. The sea-level overpressure are shown on the upper left of Fig. 3 for three examples, Cases C, D and E, labeled, respectively, in thin solid curve, in dashes, and in dash-dot curve. They model the plume extension by the addition after the real shock of Case A (shown in heavy full dots) a linear axial variation, as depicted. Case C (in thin solid line) has a shorter plume extension, the length of which is determined by requiring the positive and negative areas to balance with each other. The remaining Cases D and E have the same plume extension length called for by the 9:1 ratio. In Case D, the area on the negative portion is 1.8 time that in the positive portion, while in Case E with a greater negative overpressure contribution, the corresponding area ratio is 2.7. As were the data from the Apollo records during ascent, the longer tail portions of Cases D and E give a nonvanishing sink effect in the farfield, noticeable at the larger depths. These results confirm that, even without accounting for the full length of the real plume, the overpressure in the range of 0.01 to 2 (mentioned earlier) can be found within a depth

of 1,000 ft., or about one *third* of a *kilometer*. In Cases D and E, disturbances at depth of 300 ft. (close to 100 meters) of the order up to 0.10 and 0.20 psf are predicted even at 1,000 ft. or 1/3 km, below sea level.

The above study based on the flat-ocean model confirms that under the flight track, the sonic-boom disturbances produced by the Kodiak Minute-Man model can penetrate under water with overpressure level comparable to 1 psf at 100 ft. depth and 0.1 psf at depth as large as 1,000 ft. Unlike the much larger Apollo, Titan or Atlas Launch vehicles, however, the Minute-Man shot is not expected to produce acoustic disturbances/noise that can noticeably reach down to the ocean wave guide in most part of the globe.

Surface Waviness Influence

In the absence of a more appropriate analysis to establish the importance of the sonic boom and surface wave interaction effect on the superboom-like domain (which would call for solving a time-dependent, nonlinear version of the Tricomi equation with a wavy wall boundary), we shall examine the result of a *linear* system valid for a wavefield (horizontal) propagation velocity larger than the sea-level sound speed analyzed earlier in Ref. [10]. The work therein sought correction for a flat-ocean response to an incident N-Wave, based the theory explained earlier. The particular example given was for a *subsonic* (wavefield) Mach number under water $M_W = 0.402$, corresponding to a supersonic cruise Mach number $M_o = 2.1$ at the Stratosphere and a sea level Mach number $M_A = 1.8207$. The maximum overpressure at the sea level is 2.020 psf in this case. The wave length of the sinusoidal surface-wave train considered in this example is comparable to the incident sonic-boom signature length L', being $4L'/2\pi \approx 261.4$ ft. The maximum surface slope is taken to be $\delta = 0.1$. The root-mean-square values (rms) of resulting overpressure distributions (with the waviness corrections) are shown in Fig. 4 as solid curves at three depth levels Z = 100, 200 and 300 ft. The difference from the uncorrected overpressure in the flat-ocean model (included as dashes) are significant as depth increases. At Z = 300 ft. depth and beyond, the waviness correction becomes an effect of the first-order importance, altering the nature and power of the noise penetration under water.

For incident superboom-like wavefields comparable to those considered earlier in Case A-E for the flat-ocean model (Figs. 2,3), the linear theory yields unbounded results and is invalid. Nevertheless, the important role of the surface waviness influence in the corresponding nonlinear, elliptic-hyperbolic mixed problem should be convincingly evident from above.

Impact-Zone 3-D Description

The lateral (horizontal) extent of the impact zone is typically large compared to its windward/ streamwise dimension (even at the leading edge of the boom carpet identified with the super/ focused boom (refer to Fig. 5). A *high aspect-ratio* theory similar to the lifting-line theory in aerodynamics is therefore applicable and was demonstrated to work well in Ref. [11]. The theory reduces the problem to a *two* dimensional one and thus justifies the 2-D formulations underlying all the foregoing analyses. Essential is, however, the proper orientation of the local coordinates so that the 2-D analysis is carried out for each span station in a *plane normal* to the (curved) center line. By this procedure, contour plots for specified/chosen psf value of the overpressure may be generated for each depth level, using data from the 2-D analysis. [This plot has not yet been prepared for this presentation.]

Descent Boom Impact

The sonic booms generated along most part of the descent trajectory of the Kodiak plan will propagate along rays which may reach the ground/sea surface *far* from the *target area* sea/ground surface with much attenuated signals, or can never do so due to refraction. Significant sonic boom

impact occurs, however, near the very end of the descent phase when the vehicle/missile is decelerated to low supersonic or subsonic speed, resulting from bow shock detachment. With the exception of a vertical (downward) trajectory, a location can always be found in this instance on the propagating paraboloid-like, detached shock/wave front where the surface slope is parallel to sea/ground surface. Therefore, it should not be surprising to find the front of the descent boom hitting the sea/ground surface at nearly normal incidence, and this is indeed the case found by the ray-acoustic (PC Boom) computation for the Kodiak run.

The calculation by K. Plotkin indicates a ray-angle (measured from the vertical) closes to 6.5°. The speed of the horizontal wave-field movement may then be estimated to be the product of *cot* (6.5°) and the sea-level sound speed corresponding to a Mach number of 8.78 above the water. This gives a Mach number 1.94 under the water, that is, during a short period at and after the impact, the responding hydroacoustic wavefield will move *supersonically* under the ocean. This means that, unlike the case with ascent phase, signals will propagation with *undiminished* strength to a depth considered larger than the signal wave length, L', which will be eventually attenuated, however, by 3-D effects.

The foregoing properties of the supersonic under water wavefield would have been an extremely important aspect of the present study, if not for the other features shown in the descent-boom "foot print" according to Plotkin's analysis (Fig. 6). Whereas the maximum overpressure level in the 0.5-1.0 psf range is comparable to that in the ascent phase, the contour plot, unlike that in Fig. 5, takes on an onion-ring like pattern with the higher overpressure of 1-3 psf being found mainly on the inner ring. Unlike that in Fig. 5, the zone under 2-3 psf is limited to a transverse dimension of 2-3 nm, which forms the basis (root) of a relatively *narrow column* under water. For this reason, we do not consider the descent phase is more critical aspect of sonic boom problem for the Kodiak plan at the present stage, which certainly deserve attention in a more critical study subsequently.

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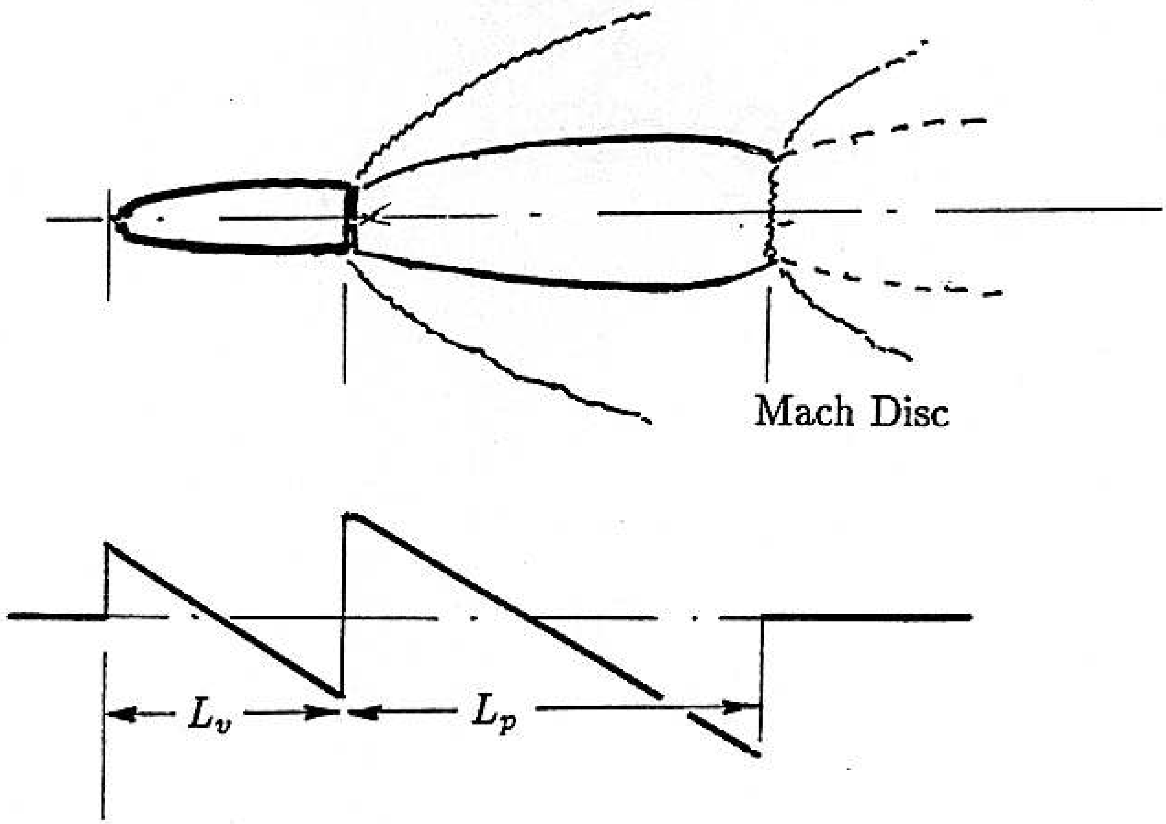

Figure 1: Starting Signature: Kodiak Launch

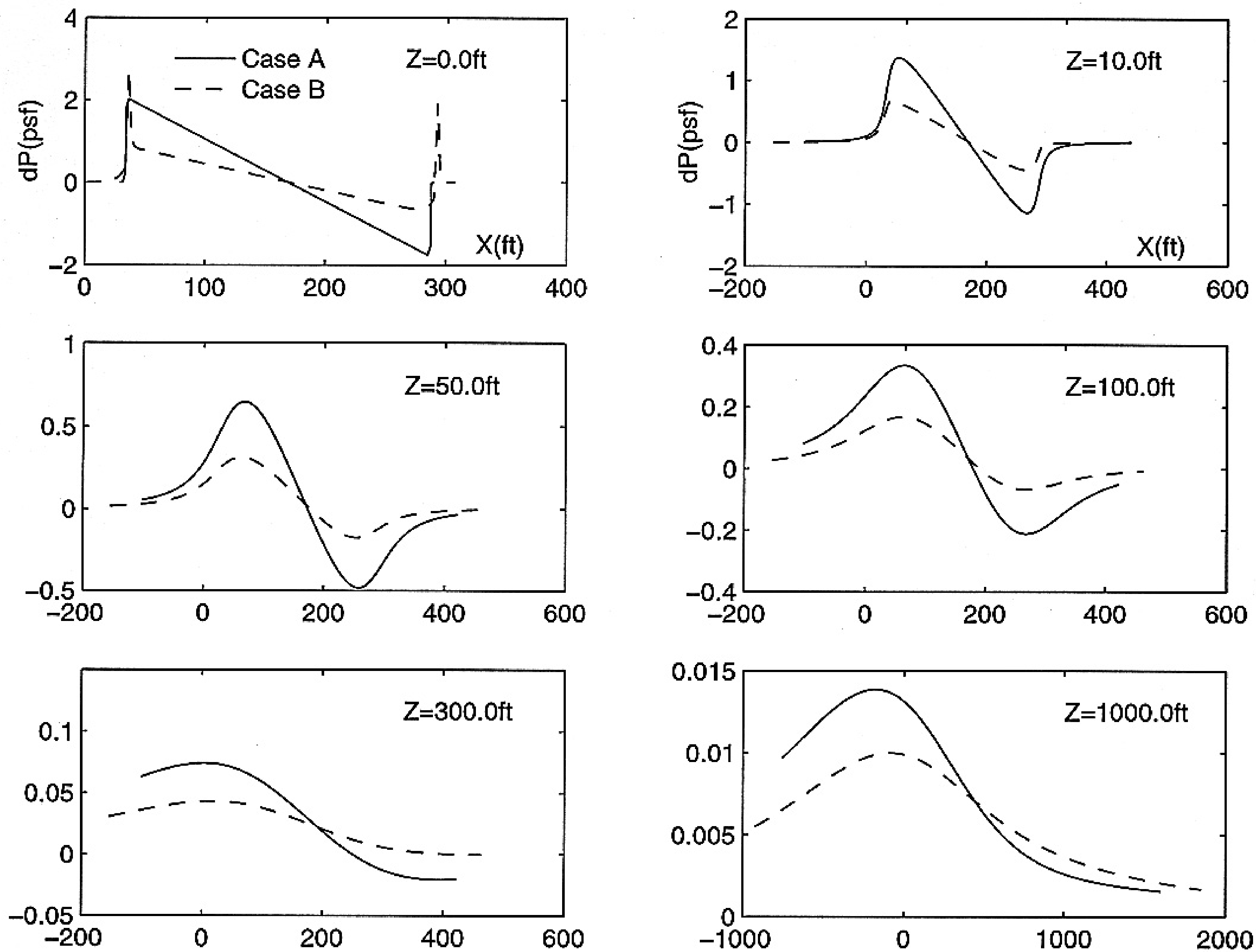

Figure 2: The overpressure distribution for Case A and B at different depths $Z = 10, 50, 100, 300$ and 1000 ft.

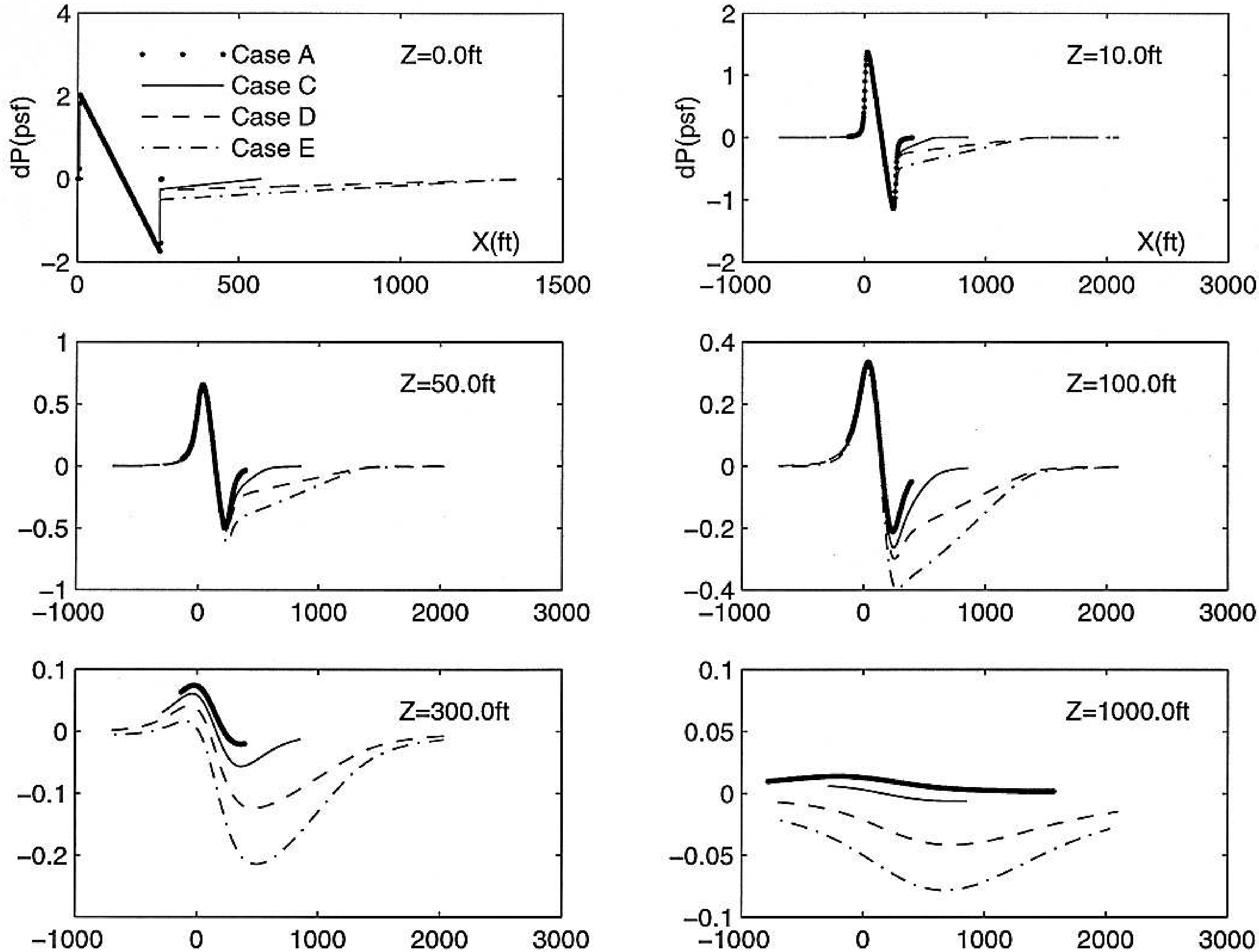

Figure 3: The overpressure distribution for Case C, D and E at different depths $Z = 10, 50, 100, 300$ and 1000 ft.

$M_A = 1.8207, k = 4, \delta = 0.1$

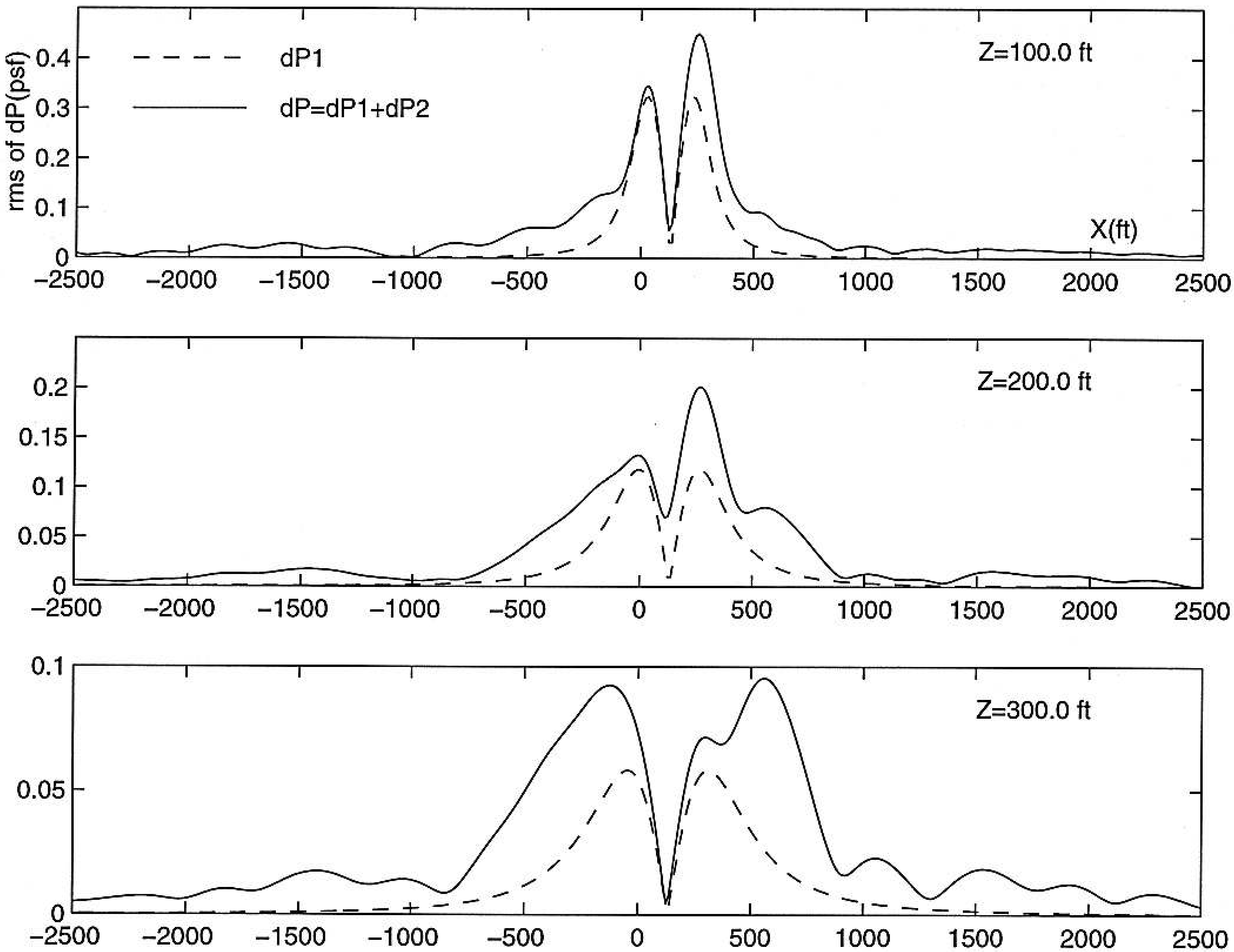

Figure 4: The root-mean-square values of overpressure distribution at three different depths $Z = 100, 200$ and 300 ft.

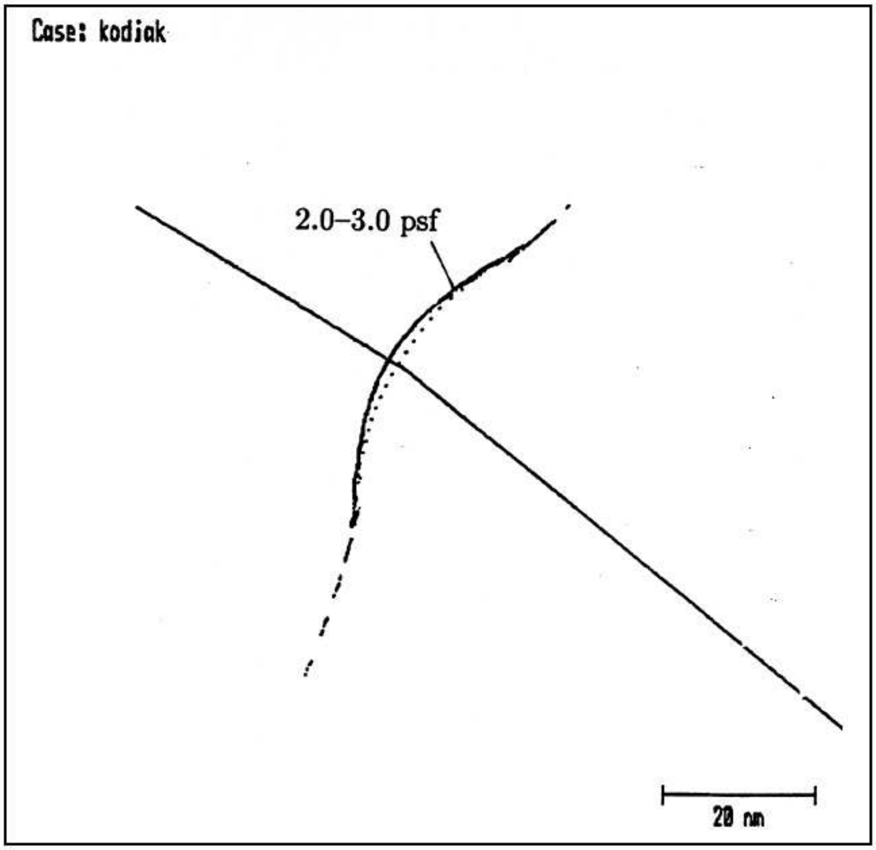

Figure 5: Overpressure Foot Print: Kodak Ascent Boom (from K. Plotkin)

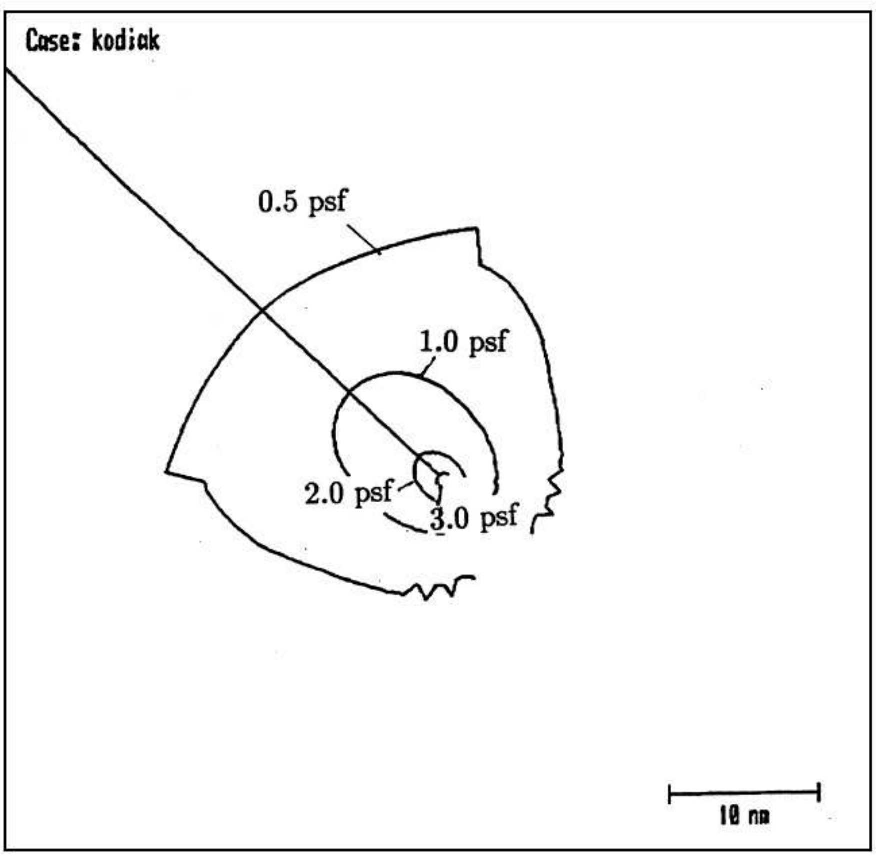

Figure 6: Overpressure Foot Print: Descent Boom (from K. Plotkin)

APPENDIX C.3
DESCENT PHASE UNDERWATER IMPACT: FURTHER ANALYSIS

DESCENT PHASE UNDERWATER IMPACT: FURTHER ANALYSIS

Additional analyses have been made on the hydroacoustic wavefields induced by (aerial) sonic boom waves towards the end of the descent phase for each of the three objects: the first stage booster, the second stage booster and the payload. The surface overpressure waveform needed as input data (boundary condition) in each case is furnished by K. Plotkin of Wyle's laboratories from a version of the PC Boom propagation code applied to the trajectories of the three descending objects. Distinctly different F-functions for these three objects have been taken into consideration to reflect their differences in drag, geometry and attack angle.[1]

Remarks on the "footprints" Figures A1 and A2 reproduced Plotkin's results of the overpressure *footprints* for the stage 1 and stage 2 booster descents. Obvious from these plots showing overpressure contours of 0.10 and 0.20 psf are the relatively low overpressure levels. Compare to that found in the ascent phase (Fig. 5 in Appendix C.2), the footprints of Figs A1 and A2 also indicate a much smaller lateral extent than that in the ascent phase (Fig. 5). These footprint data results on the (ocean) surface do suggest that the impact from the booster descents can not be more significant than those found for the ascent. However, unlike the *evanescent* wavefield behavior found underwater in the ascent case, the submarine sonic boom wavefield in the descent phase can penetrate *deeply* underwater with undiminished intensity, owing to the fact that their incident ray angles fall within the range of $\theta_i<13.5^o$. The value θ_i is the critical angle for the air-water interface (mentioned earlier in Appendix C.2). Thus the sonic boom submarine impact of the descent phase may not be considered completely insignificant. The following analysis and examination provide more specific description to the impact assessment.

In passing, one recognizes than an overpressure footprint gives the contours of maximum overpressure on the ground (sea-level) for an entire sonic-boom event and can not be related directly to the overpressure waveform on the ground (sea-level) prescribed at a given *time instant.* The lateral extent (span) of these contours may nevertheless indicate the magnitude order of the width (span) of the instantaneous (sonic-boom) impact zone where the overpressure is nonzero. The magnitude of this width/span may help to ascertain the significance/ insignificance of 3-D effects.

Method of analysis For a subsonic wavefield underwater corresponding to incident ray angle beyond the critical value ($\theta_i<13.5^0$), our quasi-stationary formulation for a flat ocean has led to solving the subsonic Prandtl-Glauert (PG) equation in two-dimension for the case with a high aspect ratio sea-level impact zone, such as the one suggested by the ascent phase sonic-boom footprint of Fig. 5 (Appendix C.2). For a supersonic underwater wavefield corresponding to $\theta_i<13.5^0$, a 3-D *hyperbolic* PG numerical solver is generally needed. This is because the overpressure footprint from the PC Boom calculation for the payload in descent reveals a rather low aspect ratio pattern (Fig. 6 of Appendix C.2) which would suggest a strong 3-D effect in the wavefield underwater. A 3-D semi-implicit, second-order, upwind finite-difference procedure was developed for this purpose, in which central differencings are used on the cross-field (y and z) operator.

[1] For example, the aerodynamic force contribution to the F-function for the stage-1 and stage-2 descent were modeled after those of the space-shuttle descent.

Shock capturing has been satisfactorily demonstrated in 2-D test cases with suitable grid refinement and artificial viscosity.

Stage 1 Booster Descent: The set of sea-level waveform data from the PC Boom program for the stage-1 booster descent has a peak overpressure close to 0.20 psf corresponding to the higher of the two levels of the contours in the footprints of Fig. A1, is chosen to provide the input (boundary condition) for the underwater calculation. This et is virtually in the form of an N-wave which is rescaled and shown at the top of Fig. A.3. The horizontal Mach number of the root of the aerial wavefield is estimated from the reciprocal of the sine of the incident ray angle, to be M_a=4.62, giving an underwater Mach number slightly higher than *unity*, M_w= 4.62/4.53 = 1.02. The lapse time of the entire signature is 0.06 sec., therefore the signature length is close to 331x4.62x0.06 92m, or L 300 ft. Since nonlinear effect has been shown as unimportant except in an M_w range much closer to unity than M_w = 1.02 (see the corrected Ref. [10] in Appendix C.2); this N-like signal is expected to propagate down with undiminished strength to a depth comparable to the half span b/2 of the impact zone where 3-D effect will begin to reduce it by a factor inversely proportional to square root of 2z/b. That is, higher the aspect ratio AR=b/L better will be the 2-D approximation.

In order to ascertain the adequacy of the 2-D method, an assessment of the 3-D effect is essential, this is found to be more expediently done by numerical program. The accuracy levels of the latter as affected by choices of the meshes and of the sizes of the computation domain, will be reported separately elsewhere. For this purposes, study of the 3-D tip effect was made for a rectangular panel which is loaded with a uniform spanwise distribution of the incident N-wave. The computation was carried out in the PG variables, i.e., x=x/L, y=By/L, z=B^z/L, with B=(M_w^2-1)$^{1/2}$. The *reduced* aspect ratio of the panel is 5 corresponding to an aspect ratio of AR=2.5/B. The computed results confirm the significant 3-D effect in the tip region and reveals an insignificant 3-D influence in a symmetry plane (y=0), even at *z* below the surface far deeper than 2.5L. In this manner, the basis for a 2-D model analysis from the supersonic underwater wavefield is established for cases with impact zones of sufficiently high aspect ratios. This observation/conclusion will be seen to be applicable to all cases of the descent phase (see below).

Accordingly, the waveform will propagate down with undiminished strength according to 9 2-D PG solution at a depth far deeper than L which 300 ft. for the stage-1 descent. This point is amplified in Fig. A3. It is important to ascertain that the effective aspect ratio is high in this case. Using the span of the contour for 0.2 psf in the footprints of Fig. A.1 as a reference, one finds a span of 15 nm. The reduced aspect ratio of the instantaneous impact zone may thus be taken as BAR = .066x15x1.85/0.10=18.1 which is indeed high. It is to be understood that the overpressure signals arriving at various stations of the (sea-level) impact zone at the same (time) instant, from which the waveform is determined, are *not* generated at the same time from the vehicle. Since the M_w is rather close to unity, we include for comparison the wavefield pattern in a case with M_w = 0.998 corresponding to M_A = 4.52 in the air. The overpressure pattern in the latter (high subsonic) case is shown in dashes. The contrast between the persistent and the evanescent behavior in these two examples of slightly different M_a illustrates the critical nature of the wavefield underwater resulting from the slight difference in incident ray angles.

The Stage 2 Booster Descent: The incident ray angle from the PC Boom data file falls beyond the critical value of 13.5^o near the terminal situation in this case, and one wave field mach number above the water is M_a = 2.014, resulting in a subsonic wavefield underwater with M_w=0.445. With the peak of 0.23 psf found in the overpressure waveform from the PC Boom data file, and evanescent wavefield behavior and scalable from the known PG solution for a surface N-wave (worked out in detail in earlier works), the stage-2 sonic boom event is seen to be far less significant than the underwater event of the ascent and the events of the stage-1 hooster and the payload. The lapse time of the surface signals is close to 60 msec, with which the signature length is estimated to be L =33/x2.014 x 0.06 = 40 m. 130 ft. Adopting the span of the 0.2 psf contour of the foot print in Fig A.2 as a reference, the aspect ratio for the impact zone is again seen to very high. A 2-D analysis suffice for the present purpose, but needs not be elaborated here.

Additional remarks on payload descent event: A discussion on the underwater wavefield towards the end of the payload descent has been given briefly in Appendix C.2. In view of the study made on the descents of stages 1 and 2, a more specific description of the underwater wavefield can be made. In spite of flower on onion-ring like pattern of the sonic-boom foot print shown previously on Fig. 6, the aspect ratio of the *instantaneous* impact zone, with which the underwater wavefield in question is determined, turns out to be again extremely *high.* This is because the overpressure waveform at the surface has a wave length L which is again very small compared to the reference span of the impact zone 2b. As noted earlier, the aerial Mach number of the wavefield at the surface is M_a=8.71 in this case, and the corresponding Mach number underwater is M_w=1.93 2, making the submarine waterfield supersonic. The wave length L in this case is simply L = 33/x2x0.033=22 m or 72 ft. This is minute compared to the shortest reference span scale based on the (very high) 3 psf contour, which is 1 nm or 1.825 km. Therefore a (local) 2-D analysis should suffice and the penetrating wavefield will be the same as that shock for the case with M_w=1.02 (Fig. A.3) except for a change of scale which makes the slope of the wave front much shallower.

Conclusion : In conclusion, except for the stage-2 booster descent, the sonic boom impact in the descent phase will result in a supersonic underwater wavefield extending deeply in the form of a column of nearly undiminished strength. Although this peak intensity are weaker than from the ascent phase, (0.2 and 2 vs. 8 psf), their intensity will be comparable or larger at depth of the order of a fraction of a km. Their lateral extents are nevertheless substantially smaller. On this basis, their importance can not be ranked with the impact of the ascent event.

APPENDIX D
COMMENTS ON DRAFT EA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services Anchorage
605 West 4th Avenue, Room 62
Anchorage, Alaska 99501-2249

IN REPLY REFER TO:

WAES

28 October, 1997

Mr. Thomas Huynh
Chief, Environmental Management Branch
Department of the Air Force
Headquarters Space and Missile Systems Center (AFMC)
SMC/AXFV
2420 Vela Way, Suite 1467
Los Angeles AFB
El Segundo, CA 90245-4659

Re: Endangered Species and the USAF ait Program at Kodiak Launch Complex

Dear Mr. Huynh,

This responds to your request for concurrence that the July, 1998 launch of a modified minuteman missile from the Kodiak Launch Complex will not affect threatened or endangered species pursuant to Section 7 of the Endangered Species Act of 1973, as amended (Act).

Based on our October 27 telephone conversation, our understanding of the project is as follows: The launch will occur in July 1997. Prior to the launch, a fully-funded U.S. Air Force seabird monitoring plan will be in place which is statistically valid, and has been approved by the U.S. Fish and Wildlife Service. During monitoring, observers will record the behavior of harlequin ducks and other sea ducks, which will be acting as behavioral surrogate species to the threatened Steller's eider. The behavior of these species will be recorded prior to the launch, during the launch (from as close to the launch site as is practical) and after the launch. Consultation as per Section 7 of the Endangered Species Act will commence for the second launch (proposed for March 1999) within 30 days of the first launch, and will be based, in part, on the results from the monitoring efforts associated with the first launch.

Based on our understanding of the project, the Service concurs that the July 1998 launch of a modified minuteman missile from the Kodiak Launch facility is not likely to adversely affect threatened or endangered species. Further consultation under Section 7 of the Act regarding this project is not necessary at this time. If the launch is delayed past September 15, or if project plans change, additional information on listed or proposed species becomes available, or new species are listed that may be affected by the project, consultation should be reinitiated.

This letter relates only to endangered species under our jurisdiction. It does not address species under the jurisdiction of National Marine Fisheries Service, or other legislation or responsibilities

under the Fish and Wildlife Coordination Act, Clean Water Act, Migratory Bird Treaty Act, or National Environmental Policy Act.

Thank you for your cooperation in meeting our joint responsibilities under the Act. If I can be of further assistance, please contact me at (907) 271-2778.

Sincerely,

Gregory R. Balogh

Gregory R. Balogh
Wildlife Biologist

L:\S7REPLY\KODIAK2.S7

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

October 24, 1997

John R. Edwards
Chief, Environmental Management Branch
Department of the Air Force
Headquarters Space and Missile Systems Center
2420 Velaway #4167
El Segundo, California 90245

ATTN: Thomas Huynh

Dear Mr. Edwards:

Thank you for your memorandum concerning the Atmospheric Interceptor Technology (AIT) program. The commitment by the Department of the Air Force to monitor the effects of these launches on local marine mammals will provide useful information towards evaluating the impacts of the Kodiak Launch Complex and the AIT program. The Draft Environmental Assessment for the AIT program has concluded these launches will not have significant effects on marine mammals. While the predicted noise levels and activity associated with the AIT program are not expected to take marine mammals, any unanticipated harm or harassment would be contrary to Federal law unless specifically authorized. The Department of the Air Force and the Federal Aviation Administration, Office of Commercial Space Transportation, have been previously advised of the authorization programs under both the Marine Mammal Protection Act and Endangered Species Act.

Please continue to contact Brad Smith at (907) 271-5006 regarding the Atmospheric Interceptor Technology program.

Sincerely,

Steven T. Zimmerman, Ph.D.
Assistant Administrator for
Protected Resources

APPENDIX E
PUBLIC COMMENTS ON DRAFT EA AND RESPONSES

COAST GUARD COMMENTS ON THE DRAFT EA

From: Boyle, Susan
Sent: Tuesday, November 04, 1997 5:16 PM
To: 'Thomas.Huynh@losangeles.af.mil'; 'CronkDM@Comanche.plk.af.mil'
Cc: 'Dilks, Drew'; Lachowsky, Robert CDR; Diehl, Bert LCDR; 'Frost, Mark'
Subject: FINAL USCG Comments on Draft AF EA for ait program -- Kodiak; rocket launch
Importance: High

Mr. Huynh and Capt Cronk:

The Coast Guard comments on the Draft EA for the USAF ait Program are listed below.

Please address these concerns in the final NEPA documentation and provide a detailed description of how significant effects from the proposed action will be avoided or adequately mitigated.

We also request that the Coast Guard have an opportunity to review and comment on safety plans before they are approved by the Air Force or its cooperators. CDR Drew Dilks, Facility Engineer at Integrated Support Command Kodiak, is the Coast Guard's point of contact. He can be reached 907 487-5317.

U. S. COAST GUARD CONCERNS:

1. COMMENTS FROM INTEGRATED SUPPORT COMMAND KODIAK (ISC KODIAK), (CDR DREW DILKS, FACILITY ENGINEER)

1.1 Reiterated concerns expressed during the development of the FAA EA, namely with regard to evacuation during launch and potential interference with the Loran signal at Narrow Cape. These issues were adequately addressed in the first EA.

1.2 Concern about the risk of injury to Coast Guard personnel from accidental detonation of explosive materials during transit and concern about having to evacuate Coast Guard personnel and facilities.

The AF is proposing to fly their rockets into Kodiak and transit over the road to Narrow Cape. The rockets contain solid rocket motors made in part of materials which are Class 1.1 and 1.3 explosives. The road to Narrow Cape over which the rockets and rocket fuel will be transported from the Kodiak airport is very rough, winding and goes through a landslide area. The road passes quite close to Coast Guard residences and facilities, including USCG Air Station Kodiak. The EA lacks a description of measures that will be implemented to avoid accidental detonation of explosives during transport and other measures which will ensure the safety of Coast Guard personnel. Safety plans are under development, but will not be completed until well after the NEPA decision document is approved.

The Final EA must describe how the AF plans to avoid all possibility of accidental detonation of explosives during transit and what other measures will be implemented in the event of an accident. The Final EA must also explain the measures that will be implemented to avoid having to evacuate personnel and facilities at ISC Kodiak, AirSta Kodiak, and COMMSTA Kodiak in connection with transport and launch of rockets. The Coast Guard must have the opportunity to review and comment on safety plans prior to their approval.

2.0 COMMENTS FROM COMMUNICATION STATION KODIAK (COMMSTA KODIAK)

2.1 Concern about the Possiblity that Coast Guard Communication Station Transmissions Could Detonate the Explosive Materials.

Air Force range safety officers provided CWO Marion of COMMSTA Kodiak with a copy of their analysis which confirmed that Coast Guard transmissions, in theory, pose a serious safety threat. The EA must clearly explain why there is no actual threat.

- The solid fuel booster is susceptible to HF transmissions which generate an RF field intensity of 2.0V/m or greater in the 2-30Mhz frequency range.
- Their standard for safety is 5,000 feet from a 1KW transmitter. There are 23 HF transmitters at COMMSTA Kodiak that can put out 10KW each to antennas that boost the effective radiated power even higher.

On Nov 6, the Air Force Range Safety Officers and technicians are coming to Commsta Kodiak to take a series of field intensity measurements to further document how intense of an RF field we generate. The Range Safety Officers may also look into shielding the missile somehow to prevent our transmission from reaching the booster.

2.2 Concern about Having to Shut Down Transmissions from Communication Station Kodiak While Missiles are Transported from the Airport to Narrow Cape.

Coast Guard missions such as SAR/MEDICO response and CG C3 (Command, Control & Control) must not be adversely affected by the proposed action. It would be unacceptible to request the COMMSTA to go off air for any amount of time.

3.0 COMMENTS FROM AIR STATION KODIAK (AIRSTA KODIAK)

3.1 Concern About Safety Zones for the Transport of Rockets Necessitating the Evacuation of Air Station Kodiak Hangars.

Evacuation of AirSta hangars would directly affect Coast Guard operations. The Air Station uses the hangars and ramp 24 hours a day on maintenance and Search and Rescue (SAR) activities. Also, any airspace/airport closures would affect routine operations and SAR posture unless it is planned well in advance, SAR-ready aircraft and crews are staged at outlying airports. The EA must explain how it will not be necessary to close the Kodiak airport, shut down operations at AirSta Kodiak, nor shut off Coast Guard aircraft access to the airport.

4.0 COMMENTS FROM LORAN STATION KODIAK (LORSTA KODIAK)

4.1 Concern about Road Closures and Access to LORSTA Kodiak, and the COMMSTA Receiver Site.

It is suggested that the MOU be non-specific about timeframes of Chiniak/Pasagshak/Narrow Cape roads access/closure, stating only that 30 minutes is max allowed - if that's what Loran OPCON and others concerned see as reasonable. Personnel from COMMSTA Kodiak also need to use these roads so there is access to the receiver site in case emergency repairs are required. Access to the DGPS site at Miller Field requires use of the Chiniak road, too. It is also suggested that the MOU clearly state that AADC be the single point of contact for oversight of all road closures and that AADC be responsible for seeing that the 30 minute maximum time for road closure is not exceeded.

The Coast Guard also requests that alternative transportation means be considered if road closures exceed agreed upon lengths of time. (According to some Coast Guard reviewers, 30 minute closures are the maximums; others stated that a slightly longer period would be acceptible.)

4.2 Suggested Modification to Text of EA and General Comments.

LAUNCH PROTOCOL HOLDS FOR CG: change to "... holds for CG signal outages or other reasons as determined by the Coast Guard..." This subtle change leaves me the option of running my station as I deem appropriate to meet mission requirements, and removes that option from AADC.

The rest of the summary looks superb. Appears AADC has the local well digger exploring for water at Narrow Cape. The well digger's flat tire fixing official indicates their search is for fire fighting water only. Maybe so. Several drill pads are in place and they're working at it.

Sincerely,

Susan L. Boyle
Chief, Environmental Branch
Maintenance & Logistics Command Pacific
Civil Engineering Division
Coast Guard Island, #54D
Alameda, CA 94501-5100

Commander (se)
TEL: 510 437-3973
FAX: 510 437-5753
EMAIL: SBoyle@d11.uscg.mil

RESPONSE TO E-MAIL COMMENTS FROM U.S. COAST GUARD RECEIVED NOVEMBER 4, 1997

COMMENT NO. 1.1
Reiterated concerns expressed during the development of the FAA EA, namely with regard to evacuation during launch and potential interference with the Loran signal at Narrow Cape. These issues were adequately addressed in the first EA.

USAF RESPONSE:
The U.S. Coast Guard Loran Station Kodiak (LORSTA Kodiak) is normally unoccupied. Should personnel be present, there may be a requirement to evacuate LORSTA Kodiak during the USAF *ait* launch period, approximately five hours. The final analysis of the launch site safety zone will determine which facilities and area must be cleared prior to a launch. If emergency maintenance is required at LORSTA Kodiak, the launch will be delayed until LORSTA Kodiak is operational and the area is clear. During the launch period the U.S. Coast Guard will have access to the USAF *ait* countdown communication network and have the capability to delay the launch if required. Based upon this comment, this information has been added to the USAF Final EA at Section 4.5.1.1, paragraph 7.

Possible signal interference will be analyzed and if necessary the USAF *ait* telemetry will be modified to eliminate interference. Based upon this comment, this information has been added to the USAF Final EA at Section 4.5.1.2.1 paragraph 7, and Section 5.5, paragraph 3.

COMMENT NO. 1.2
Concern about the risk of injury to Coast Guard personnel from accidental detonation of explosive materials during transit and concern about having to evacuate Coast Guard personnel and facilities. The AF is proposing to fly their rockets into Kodiak and transit over the road to Narrow Cape. The rockets contain solid rocket motors made in part of materials which are Class 1.1 and 1.3 explosives. The road to Narrow Cape over which the rockets and rocket fuel will be transported from the Kodiak airport is very rough, winding and goes through a landslide area. The road passes quite close to Coast Guard residences and facilities, including USCG Air Station Kodiak. The EA lacks a description of measures that will be implemented to avoid accidental detonation of explosives during transport and other measures which will ensure the safety of Coast Guard personnel. Safety plans are under development, but will not be completed until well after the NEPA decision document is approved. The Final EA must describe how the AF plans to avoid all possibility of accidental detonation of explosives during transit and what other measures will be implemented in the event of an accident. The Final EA must also explain the measures that will be implemented to avoid having to evacuate personnel and facilities at ISC

Kodiak, AirSta Kodiak, and OMMSTA Kodiak in connection with transport and launch of rockets. The Coast Guard must have the opportunity to review and comment on safety plans prior to their approval.

USAF RESPONSE:
The rocket motors used for USAF *ait* are inherently safe. It would take an extraordinary event to cause an accidental detonation. All USAF *ait* plans involving U.S. Coast Guard personnel or facilities will be submitted to the U.S. Coast Guard for coordination prior to implementation. Included among these plans is the emergency response plan, Recovery Guide for Rocket System Launch Program Motor Transportation Mishaps, dated June 1993, addressing potential mishaps during the actual transportation of the motors. The USAF *ait* motors will be contained in specially designed trailers during transit to KLC. These trailers are designed for the transportation of Minuteman rocket motors and meet all legal guidelines required during transportation. The trailer has an environmental control system which maintains the temperature inside the trailer. It was designed for use with commercial tractors and has been used for over the road shipment of Minuteman rocket motors for over 30 years. The motors will not have to leave the trailer during shipment to KLC. A modified version of this trailer has been certified for air transportation of a similar launch vehicle. The certification for air transportation of the USAF *ait* version of the trailer will be accomplished prior to shipment. This trailer is also DoD approved for transporting high explosives on public roads. Even though there have been transporter vehicle mishaps there has never been a rocket motor detonation. Similar rocket motor configurations have been transported on public roads from Hill AFB, UT to White Sands Missile Range (WSMR), NM over a dozen times. The roads to WSMR are dirt roads similar to the gravel roads leading to KLC. Based upon this comment, this information has been added to the USAF final EA at Section 4.5.1.1, paragraphs 3 and 4.

COMMENT NO. 2.1
Concern about the possibility that Coast Guard Communication Station transmissions could detonate the explosive materials. Air Force range safety officers provided CWO Marion of COMMSTA Kodiak with a copy of their analysis which confirmed that Coast Guard transmissions, in theory, pose a serious safety threat. The EA must clearly explain why there is no actual threat. The solid fuel booster is susceptible to HF transmissions which generate an RF field intensity of 2.0V/m or greater in the 2-30Mhz frequency range. Their standard for safety is 5,000 feet from a 1KW transmitter. There are 23 HF transmitters at COMMSTA Kodiak that can put out 10KW each to antennas that boost the effective radiated power even higher. On Nov 6, the Air Force Range Safety Officers and technicians are coming to Commsta Kodiak to take a series of field intensity measurements to further document how intense of an RF field we generate. The Range Safety Officers may also look into shielding the missile somehow to prevent our transmission from reaching the booster.

USAF RESPONSE:
As noted in the comment, USAF *ait* range safety officers are having ongoing discussions with U.S. Coast Guard Communications Station personnel on this issue. Based on the field intensity

measurements and the rocket motors' vulnerability, the USAF *ait* program will take whatever steps are necessary to preclude inadvertent detonation. All decisions and agreements required for RF protection will be submitted to the U.S. Coast Guard for coordination prior to implementation. Based upon this comment, information has been added to the USAF Final EA at Section 4.5.1.2.1 paragraph 7, and Section 5.5, paragraph 3.

COMMENT NO. 2.2
Concern about having to shut down transmissions from Communication Station Kodiak while missiles are transported from the airport to Narrow Cape. Coast Guard missions such as SAR/MEDICO response and CG C3 (Command, Control & Control) must not be adversely affected by the proposed action. It would be unacceptable to request the COMMSTA to go off air for any amount of time.

USAF RESPONSE:
There are no plans to request the shut down of U.S. Coast Guard transmissions.

COMMENT NO. 3.1
Concern about safety zones for the transport of rockets necessitating the evacuation of Air Station Kodiak hangars. Evacuation of AirSta hangars would directly affect Coast Guard operations. The Air Station uses the hangars and ramp 24 hours a day on maintenance and Search and Rescue (SAR) activities. Also, any airspace/airport closures would affect routine operations and SAR posture unless it is planned well in advance, SAR-ready aircraft and crews are staged at outlying airports. The EA must explain how it will not be necessary to close the Kodiak airport, shut down operations at AirSta Kodiak, nor shut off Coast Guard aircraft access to the airport.

USAF RESPONSE:
There are no plans to shut down operations at the U.S. Coast Guard Air Station Kodiak nor the Kodiak airport for transportation and unloading of USAF *ait* assets. As stated in the USAF response to U.S. Coast Guard comment to 1.2, above, we will be using a transportation trailer approved for shipments of explosives on the open road and will not require any operations to be shut down while moving the rocket motors. There may be a safety zone established while unloading the transportation trailer from the C-5 aircraft but this will not impact air field operations.

COMMENT NO. 4.1
Concern about road closures and access to LORSTA Kodiak, and the COMMSTA receiver site. It is suggested that the MOU be non-specific about time frames of Chiniak/Pasagshak/Narrow Cape roads access/closure, stating only that 30 minutes is max allowed - if that's what Loran OPCON and others concerned see as reasonable. Personnel from COMMSTA Kodiak also need to use these roads so there is access to the receiver site in case emergency repairs are required. Access to the DGPS site at Miller Field requires use of the Chiniak road, too. It is also suggested that the MOU clearly state that AADC be the single point of contact for oversight of all road

closures and that AADC be responsible for seeing that the 30 minute maximum time for road closure is not exceeded. The Coast Guard also requests that alternative transportation means be considered if road closures exceed agreed upon lengths of time. (According to some Coast Guard reviewers, 30 minute closures are the maximums; others stated that a slightly longer period would be acceptable.)

USAF RESPONSE:
There is currently no requirement to shut down the Chiniak/Pasagshak/Narrow Cape roads for transportation of the USAF *ait* rocket motors. The only roads that may have to be shut down are those on the KLC and these will be for less than 30 minutes to move the motors from one KLC facility to another and for approximately five hours during launch day operations. All USAF *ait* plans involving U.S. Coast Guard personnel or facilities will be submitted to the Coast Guard for coordination prior to implementation.

COMMENT NO. 4.2
Suggested modification to text of EA and general comments.

LAUNCH PROTOCOL HOLDS FOR CG: change to "... holds for CG signal outages or other reasons as determined by the Coast Guard..." This subtle change leaves me the option of running my station as I deem appropriate to meet mission requirements, and removes that option from AADC. The rest of the summary looks superb. Appears AADC has the local well digger exploring for water at Narrow Cape. The well digger's flat tire fixing official indicates their search is for fire fighting water only. Maybe so. Several drill pads are in place and they're working at it.

USAF RESPONSE:
It is assumed this response refers to a draft U.S. Coast Guard-AADC MOA. The USAF has not seen that draft MOA, but concurs that the U.S. Coast Guard’s safety mission takes precedence over USAF *ait* launches.

October 30, 1997

Dear Mr. Huynh,

My wife and I have opposed the Kodiak Launch Complex for several reasons - the most prominent of these being the spoiling of another few thousand acres of increasingly rare wilderness when other less harmful alternatives are available. We have a few comments to make on your Air Force Environmental Assessment:

1) Did the Air Force prepare a cost analysis of alternative launch platforms such as from aircraft or ships? Is it really more cost effective and timely to construct an entire new land based launch facility for 2 sub orbital flights to test your AIT program? Thats hard to swallow.

2) Neither the FAA nor AF EA mentions the gray whale migration. Virtually all of the 23-27,000 eastern Pacific gray whale population migrates past (within ¼ mi) Narrow Cape from March → May and again in the fall on their way south. The effects of launch <u>and</u> in flight noise and possible missile failure and exhaust fallout on whales in the area should be investigated.

3) No information is provided in either EA on inflight noise although on page 4-11 of the Air Force EA a statement is made that launch pad noise is typically much <u>lower</u> than in flight noise. Specifically - how loud is the missile

when directly over the sea lion ~~rookery~~ haul-out on Ugak Island? By the way the Stellar Sea lion is endangered and yet there is no mention of that fact in either EA.

If in-flight noise is at a higher level than launch pad noise - then it may indeed have a significant impact on wildlife in the area. Why has this been ignored in the EA? Are 'temporary shifts in auditory thresholds' insignificant?

4) Lastly Mr Huynh, on page 2 at the bottom it is stated that no significant impact will result from the US Air Force AIT program. Isn't this a draft EA? Who has made this finding of no significant impact and how can that happen before the public has been allowed to review and comment on the EA? What about cumulative impacts? Even assuming that each individual launch has so low an impact that it is considered by some to be insignificant - don't these impacts add up? Will the Air Force fund the construction of KLC and then stop at 2 launches?

Please consider these comments. There is a feeling among many people that we have been misled about the true nature of the KLC. News of missile defense systems testing, Pentagon funding - military involvement was not made available to the public until early March of this year. For that reason there is the suspicion that we are still not getting the full story - that the KLC is being built regardless of the

potential impacts - regardless of what the public comments might be - Thanks for your time -

Sincerely, Dan S. Dunn

Dan S. Dunn

Susan Payne

Susan Payne

P.O. Box 1903

KODIAK, AK 99615

RESPONSE TO COMMENTS
LETTER FROM DON S. DUNN AND SUSAN PAYNE
OCTOBER 30, 1997

COMMENT NO. 1
"Did the Air Force prepare a cost analysis of alternative launch platforms such as from aircraft or ships? Is it really more cost effective and timely to construct an entire new land based launch facility for 2 sub orbital flights to test your AIT program? That's hard to swallow."

USAF RESPONSE:
The USAF did not prepare a formal cost analysis of the sea and air launch alternatives because the capability to launch the USAF *ait* vehicle from sea and air would have required additional research and development costs, roughly estimated at $10 to $40 million, over and above those associated with a ground launch. The technology and facilities for sea and air launch systems for sub-orbital vehicles, such as the USAF *ait* test vehicle, are not currently available. The USAF *ait* program is developing a target launch capability to realistically simulate inbound intercontinental ballistic missile threat trajectories. Meeting these National Missile Defense trajectory requirements using existing assets will require a multi-stage vehicle. The USAF *ait* program vehicle uses deactivated Minuteman II second and third stages. The DoD "Air Drop Target System Program" is developing an air launch target system for the Theater Missile Defense (TMD) program. This TMD launch system will be developed to support a short range, single stage rocket that uses the deactivated Minuteman II second stage. This single stage TMD vehicle does not have the performance capabilities necessary to meet the USAF *ait* program requirements of range and trajectory (velocity and altitude). The single stage TMD launch vehicle has a maximum range of 580 kilometers versus the 2,000 kilometer range of the USAF *ait* vehicle. The USAF *ait* program velocity and altitude requirements drive the need for a longer range vehicle. In addition, trying to develop an air launch capability for the USAF *ait* program is projected to cost $40M and would increase program uncertainty. Therefore, the development of such alternative launch capabilities to support the two USAF *ait* launches is not considered cost effective as compared to the use of land based launch facilities. See Sections 1.2 and 2.3.1 of the USAF EA.

COMMENT NO. 2
"Neither the FAA nor the AF EA mentions the gray whale migration. Virtually all of the 23-27,000 eastern Pacific gray whale population migrates past (within 1/4 mile) Narrow Cape from March to May and again in the Fall on their way South. The effects of launch and in flight noise and possible missile failure and exhaust fallout on whales in the area should be investigated."

USAF RESPONSE:
The USAF recognizes that whales are protected species. Section 4.5.2.3 of the FAA EA specifically analyzed and addressed the potential impacts from launch operations from the Kodiak Launch Complex to marine mammals. The USAF adopts this FAA EA analysis and findings (see USAF EA section 1.3 paragraph 2 and section 4.3). This included an analysis of the seven whale species found in the waters near Kodiak Island. In its analysis, the FAA EA indicated that of the seven whale species, only the humpback whale and the gray whale use the nearshore waters of Narrow Cape and Ugak Island.

The FAA EA determined that due to the following, humpback and gray whales are not expected to be affected by launch operations from the Kodiak Launch Complex:

- Relatively small number of launches planned per year.

- Whales are found in the Narrow Cape area during only part of the year with the peak migratory periods occurring in Apr-May and Nov-Dec.
- Calving and breeding would not be disrupted.
- Expected attenuation of launch noise at the air-water interface.

The current plan is for both USAF *ait* launches to occur outside the peak whale migratory periods of Apr-May and Nov-Dec. Before any proposed rescheduling of launches into these peak periods, the USAF would consult with, and gain approval of the National Marine Fisheries Service (NMFS).

Based upon this comment, the final USAF EA incorporates this information in Section 4.3.1.2 paragraphs 2 and 4, and Section 5.3, paragraph 4.

<u>COMMENT NO. 3</u>
"No information is provided in either EA on inflight noise although on page 4-11 of the Air Force EA a statement is made that launch pad noise is typically much <u>lower</u> than in flight noise. Specifically - how loud is the missile when directly over the sea lion haul-out on Ugak Island. By the way the Steller Sea lion is endangered and yet there is no mention of that fact in either EA.

If in-flight noise is at a higher level than launch pad noise - Then it may indeed have a significant impact on wildlife in the area - Why has this been ignored in the EA? Are 'temporary shifts in auditory thresholds' insignificant?"

<u>USAF RESPONSE:</u>
The USAF *ait* trajectory analysis, as displayed in Figure 4.5-1, show the vehicle will not overfly Ugak Island. As discussed in Section 4.3.1.3 and as shown of Figure 4.4-2 of the USAF EA, inflight noise from the USAF *ait* test vehicles will be approximately 85 dBA at the Steller sea lion haulout area on Ugak Island. On-pad noise levels from the USAF *ait* launches are shown on Figure 4.4-1 of the USAF EA. As noted in the October 24, 1997 letter from the National Marine Fisheries Service (NMFS) included in Appendix D of the Final USAF EA, the USAF has consulted with the NMFS regarding the Steller sea lion as required by the Endangered Species Act and the Marine Mammal Protection Act. See also Section 4.3 paragraph 1 and Section 4.3.1.2 of the USAF EA and page 4-48 of the FAA EA.

On May 5 1997, the National Marine Fisheries Service (NMFS) announced that effective June 4, 1997, the Steller sea lion population West of longitude 144 degrees would be re-classified as endangered. However, the threatened listing is being maintained for the remainder of the U.S. Steller sea lion population. The launch facility and the overflight areas are West of longitude 144. In a letter dated October 24, 1997, and in subsequent conversations, the National Marine Fisheries Service (NMFS) concurred with the USAF's opinion that predicted launch and overflight noise will not have significant effects on marine mammals. However, because the USAF assessments are based on predicted rather than measured noise levels, NMFS has requested and the USAF has agreed to perform NMFS approved monitoring of Steller sea lion haulouts before, during and after the first USAF *ait* launch. This monitoring will be similar to that described above with regard to the Steller's eider. As with the Steller's eider, the second launch will be conducted in accordance with consultation with NMFS regarding the monitoring results from the first launch so as to avoid adversely affecting threatened or endangered marine mammals.

Based upon this comment, the final USAF EA incorporates this information in Section 3.3.2, Section 4.3.1.2 paragraph 2 and Section 5.3, paragraph 5.

COMMENT NO. 4

"Lastly Mr. Huynh, on page 2 at the bottom it is stated that no significant impact will result from the US Air Force AIT program. Isn't this a draft EA ? Who has made this finding of no significant impact and how can that happen before the public has been allowed to review and comment on the EA ? What about cumulative impacts ? Even assuming that each individual launch has so low an impact that it is considered by some to be insignificant - don't these impacts add up ? Will the Air Force fund the construction of KLC and then stop at 2 launches ?"

USAF RESPONSE:

This comment refers to page 2 of the Draft Finding of No Significant Impact (FONSI). The draft FONSI is provided to allow reviewers to understand the context in which the FONSI could be made. The USAF decision makers will take the information available in the Final EA, agency and public comments, and the USAF's responses to the agency and public comments into consideration when they make a decision regarding the project.

Cumulative impacts were analyzed in Chapter 4.0 of the EA. Based on discussions with the Alaska Aerospace Development Corporation, it is anticipated that the two USAF *ait* launches will be the first two launches from the Kodiak Launch Complex. The EA determined that the cumulative impacts resulting from the launch of the two USAF *ait* test vehicles would be an insignificant contribution to past, present, or reasonably foreseeable future actions at the Kodiak Launch Complex.

With the exception of the two proposed USAF *ait* launches from the Kodiak Launch Complex, the USAF has no identified plans to launch other vehicles from the Kodiak Launch Complex. Should the USAF identify other launch requirements that could be supported by the Kodiak Launch Complex in the future, the USAF would conduct any required additional environmental analysis to address the potential environmental impacts from such future actions.

Oct. 29, 1997

Janet L. Axell
Box 3895
Kodiak, AK. 99615

Mr. Thomas Huynh

Dear Mr. Huynh.

I have reviewed the Draft Environmental assessment for U.S. Air Force atmospheric interceptor technology Program, October, 1997 for KLC. I have some questions, concerns and comments.

In section 2-1 you state that DOD has successfully launched 6 vehicles similar to the Minuteman with second and third stage solid rocket motors which are planned for the two KLC launches. This is incomplete information. Similar in what way? Six successful launches out of how many attempts??

Section 2-3.1 & the EA says that sea and air launches don't meet the low risk, low cost criteria. I ask to see a cost analysis for sea and air

launches as compared to possible ground launches at KLC in which DOD is willing to spend $18 million for two launches.

Also, what is the risk and possible failure rates of launches at sea or in the air? Give us some data please!

Section 4-2 refers to the wind speed and direction at the Kodiak Airport. Kodiak Island is a place where many weather fronts meet. Wind direction is highly variable in different parts of the island. Wind speeds are generally much higher and gusty at capes and passes which we hear in our weather forcasts on a regular basis, and which I experience at my salmon setnet site which is located on a cape. You have not given any consideration to this.

Section 4-8 4. says the chance of a launch failure is remote. What is your definition of remote. What are the percentages of launch failures/successes? Please give supporting statistics.

Page 4-9, 4.3.1.4 says that in case of failure the chance of hitting whales, etc. is remote. How many pieces of what size fall over how large an area in case of failure?

Construction of KLC has not yet begun and yet the Air Force plans on launching in July, 1998 and March 1999. Even if it were on schedule a March launch could easily be during the beginning of the Grey Whale migration or even extend into the height of it in April if there were weather or other delays. Many of us wrote about the Grey Whale Migration before the draft EA. This draft EA is a Flawed Report. There is no mention of the 23,000 Grey Whales which migrate past Narrow Cape from late March to June and again in the fall for 2 months. This omission is a DELIBERATE MANIPULATION and MISREPRESENTATION of the TRUTH. Depending on the day of a planned launch and the whales on that particular

day it could be possible to have a hundred or more whales in the launch path over several mile area. These are large whales. It could be comparable to a hundred fishing boats milling around. If there were a hundred fishing boats there would you still fire the rocket? Whales are intelligent beings and they deserve as much consideration for their safety as humans.

We have many species of whales here. I ask that you make a statement of intention to not fire rockets/missiles when whales are present in the vicinity.

Page 4-14 4.4.2 you state that there are no cumulative impacts since each launch has no significant impact. I beg your pardon?? HCl stays 3 years

in the stratosphere, affecting the ozone layer and then filters down to the troposphere (4-4-5 2.) Al_2O_3 takes weeks to years to diffuse out of the stratosphere. We need to very carefully consider the cumulative effects of <u>all</u> of the <u>launches worldwide</u> and the ozone depleting effects of manufacturing pollution and automobiles, etc. I have enclosed a portion of an article I wrote which I'd like you to read.

Thank you for considering all these points more deeply. I am opposed to KLC. I don't think a launch facility here, funded by my tax dollars is in our best interests.

Sincerely, for the highest good,

Janet Apell

Regarding the proposed Kodiak Rocket Launch Complex, legislation was passed at federal and state levels to decrease environmental accountability. We are treating the Earth and her atmosphere as an expendable commodity. This must change! The earth is a living being, God's creation of intricate balance.

A proton, electron and neutron comprise an atom, many atoms a molecule, many molecules a cell, many cells with individuated function make a heart, a brain, a bone, etc., and the totality a human being. In the same way we humans, all animals, the plant kingdom, water, soil, minerals and air make up this wonderful creation that is the body of earth.

Both the human body and the Earth are equipped to process a certain amount of toxins out of our systems. But when a critical mass of toxins is present the system begins to fail, resulting in illness or death.

During the next decade 1,800 new telecommunications satellites are proposed to be launched. Who knows how many more will be launched by the military worldwide in their tests and war games? The cumulative effect of this is large scale pollution. How much pollution can we allow in the Earth and her atmosphere before breakdown occurs? Nobody knows.

Our food, the very air we breathe and everything we need for our physical survival and comfort we receive from the Earth. It is of vital importance that we carefully screen the necessity of missiles and satellites proposed for launching, and proceed with caution. We need to move away from decisions ruled by the ego and its fear and view of the self as separate. Let us choose to learn to function from the higher viewpoint of the soul. We can then make decisions in a direct knowing of the unity and interconnectedness of all life and live in health and harmony with all that is.

—Janet Axell

RESPONSE TO COMMENTS
LETTER FROM JANET AXELL
OCTOBER 29, 1997

COMMENT NO. 1:
"In section 2-1 you state that DOD has successfully launched 6 vehicles similar to the minuteman with second and third stage solid rocket motors which are planned for the two KLC launches. This is incomplete information. Similar in what way ? Six successful launches out of how many attempts ??"

USAF RESPONSE:
The other sub-orbital vehicles launched by the Department of Defense (DoD) mentioned in section 2.1 were the Army Hera vehicles and Ground Based Interceptor (GBI) launchers consisting of the same configuration of deactivated Minuteman II second and third stages that would be used by the USAF *ait* test vehicle. DoD has now launched seven Hera and one GBI vehicles, all eight of which were successful. Based upon this comment, this information has been incorporated into the final Air Force EA at Section 2.1.1 paragraph 1.

COMMENT NO. 2
"In section 2-3.1 of the EA says that sea and air launches don't meet the low risk, low cost criteria. I ask to see a cost analysis for sea and air launches as compared to possible ground launches at KLC in which DOD is willing to spend $18 million for two launches.

Also, what is the risk and possible failure rates of launches at sea or in the air ? Give us some data please."

USAF RESPONSE:
The USAF did not prepare a formal cost analysis of the sea and air launch alternatives because the capability to launch the USAF *ait* vehicle from sea and air would have required additional research and development costs, roughly estimated at $10 to $40 million, over and above those associated with a ground launch. The technology and facilities for sea and air launch systems for sub-orbital vehicles, such as the USAF *ait* test vehicle, are not currently available. The USAF *ait* program is developing a target launch capability to realistically simulate inbound intercontinental ballistic missile threat trajectories. Meeting these National Missile Defense trajectory requirements using existing assets will require a multi-stage vehicle. The USAF *ait* program vehicle uses deactivated Minuteman II second and third stages. The DoD "Air Drop Target System Program" is developing an air launch target system for the Theater Missile Defense (TMD) program. This TMD launch system will be developed to support a short range, single stage rocket that uses the deactivated Minuteman II second stage. This single stage TMD vehicle does not have the performance capabilities necessary to meet the USAF *ait* program requirements of range and trajectory (velocity and altitude). The single stage TMD launch vehicle has a maximum range of 580 kilometers versus the 2,000 kilometer range of the USAF *ait* vehicle. The USAF *ait* program velocity and altitude requirements drive the need for a longer range vehicle. In addition, trying to develop an air launch capability for the USAF *ait* program is projected to cost $40M and would increase program uncertainty. Therefore, the development of such alternative launch capabilities to support the two USAF *ait* launches is not considered cost effective as compared to the use of land based launch facilities. See Sections 1.2 and 2.3.1 of the Air Force EA.

As noted above, existing facilities for sea and air launch of sub-orbital vehicles, such as the USAF *ait* test vehicle, are not currently available. Therefore, there is no risk or launch failure rate data for sea and/or air launch facilities.

COMMENT NO. 3

"Section 4-2 refers to the wind speed and direction at the Kodiak Airport. Kodiak Island is a place where many weather fronts meet. Wind direction is highly variable in different parts of the island. Wind speeds are generally much higher and gusty at capes and passes which we hear in our weather forecasts on a regular basis, and which I experience at my salmon setnet site which is located on a cape. You have not given any consideration to this."

USAF RESPONSE:

There is no site specific meteorological data for Narrow Cape. Therefore, data from the nearest location, in this case the Kodiak Airport, was used for analysis in the FAA EA and the USAF EA. The USAF believes the use of data from the nearest location provides representative data for the types of analysis conducted to support both EAs. However, the USAF analyzed the conditions most likely to produce adverse air quality impacts. This analysis found that even those conditions would produce no significant air quality impacts. See USAF EA Section 4.2.1.1 and FAA EA Section 4.1.2.

COMMENT NO. 4

"Section 4-8 4. Says the chance of a launch failure is remote. What is your definition of remote. What are the percentages of launch failures/successes ? Please give supporting statistics."

USAF RESPONSE:

As noted above in response to Comment No. 1, DoD has successfully launched eight vehicles that consisted of the same configuration of deactivated Minuteman II second and third stages that would be used by the USAF *ait* test vehicle. Additionally, DoD has launched 99 various configurations of two and three stage excess ballistic missiles for a number of years, with a success rate of 96 percent.

Launches by their very nature involve some degree of risk and it is for this reason that the Department of Defense has specific launch and range safety policies and procedures to assure that the public and government assets (i.e., launch support facilities) are not put at risk. The following documents will be published by the Naval Air Warfare Center (NAWC), Pt Mugu prior to the first proposed USAF *ait* deployment;

Range Safety Operation Plan
Formal Range Safety Approval of Flight Termination System
Hazardous Operation Procedures
Ground Safety Plan
Communication Plan
Frequency Coordination Plan.

Also see USAF EA Sections 3.5.2, 4.5.1.2, and 5.5 and FAA EA Sections 4.6 and 5.6.
Based upon this comment, the final USAF EA incorporates this information in Section 4.5.1.2.1, paragraphs 2 and 3.

COMMENT NO. 5

"Page 4-9, 4.3.1.4 says that in case of failure the chance of hitting whales, etc. is remote. How many pieces of what size fall over how large an area in case of failure ?"

USAF RESPONSE:

The USAF believes the chance of hitting a whale by falling debris from a USAF *ait* vehicle, in the unlikely event of a launch failure, is remote because of the current launch schedule and the projected pattern in which the debris would fall.

The current plan is for both USAF *ait* launches to occur outside the peak whale migratory periods of Apr-May and Nov-Dec. Before any proposed rescheduling of launches into these peak periods, the Air Force would consult with, and gain the approval of National Marine Fisheries Service (NMFS).

Depending on the time of the failure, some debris could potentially fall in areas of the Pacific Ocean used by marine mammals, including migratory whales and pelagic species. The debris would not fall in a concentrated pattern. As an example, if the booster were to fail 30 seconds into flight, the debris pattern is expected to land in an oval pattern, no closer than one mile North East of Ugak Island. The debris pattern is predicted to be made up of 113 pieces of the detonated first stage, most of which will be in the 50 to 200 pound range, plus the second stage and payload which will remain intact. The debris oval for this example is predicted to be approximately 1 mile long by 1/2 mile wide comprising an area of 335 acres. This results in a debris density of about 1 piece per 3 acres of open ocean. In addition, the chance of a marine mammal being near the surface in the debris area is also limited. Therefore, the chance of a marine mammal being hit by a piece of debris is considered remote.

Based upon this comment, the final USAF EA incorporates this information in Section 4.3.1.2, paragraphs 2, 4, and 6, and Section 5.3 paragraph 4.

COMMENT NO. 6

"Construction of KLC has not yet begun and yet the Air Force plans on launching in July, 1998 and March 1999. Even if it were on schedule a March Launch could easily be during the beginning of the Grey Whale migration or even extend into the height of it in April if there were weather or other delays. Many of us wrote about the Grey Whale Migration before the draft EA. This draft EA is a Flawed Report. There is no mention of the 23,000 Grey Whales which migrate past Narrow Cape from late March to June and again in the fall for 2 months. This omission is a DELIBERATE MANIPULATION and MISREPRESENTATION of the TRUTH. Depending on the day of a planned launch and the whales on that particular day it could be possible to have a hundred or more whales in the launch Path over several mile area. These are large whales. It could be comparable to a hundred fishing boats milling around. If there were a hundred fishing boats there would you still fire the rocket ? Whales are intelligent beings and they deserve as much consideration for their safety as humans.

We have many species of Whales here. I ask that you make a statement of intention to not fire rockets/missiles when whales are present in the vicinity."

USAF RESPONSE:

The USAF recognizes that whales are protected species. Section 4.5.2.3 of the FAA EA specifically analyzed and addressed the potential impacts from launch operations from the Kodiak Launch Complex to marine mammals. The USAF adopts this FAA EA analysis and findings (see USAF EA Section 1.3 paragraph 2 and Section 4.3). This included an analysis of the seven whale

species found in the waters near Kodiak Island. In its analysis, the FAA EA indicated that of the seven whale species, only the humpback whale and the gray whale use the nearshore waters of Narrow Cape and Ugak Island.

The FAA EA determined that due to the following, humpback and gray whales are not expected to be affected by launch operations from the Kodiak Launch Complex:

- Relatively small number of launches planned per year.
- Whales are found in the Narrow Cape area during only part of the year with the peak migratory periods occurring in Apr-May and Nov-Dec.
- Calving and breeding would not be disrupted.
- Expected attenuation of launch noise at the air-water interface.

The current plan is for both USAF *ait* launches to occur outside the peak whale migratory periods of Apr-May and Nov-Dec. Before any proposed rescheduling of launches into these peak periods, the USAF would first consult with, and gain approval of NMFS.

Based upon this comment, the final USAF EA incorporates this information in Section 4.3.1.2, paragraphs 2 and 4, and Section 5.3, paragraph 4.

COMMENT NO. 7

"Page 4-14 4.4.2 you state that there are no cumulative impacts since each launch has no significant impact. I beg your pardon ?? HCl stays 3 years in the stratosphere affecting the ozone layer and then filters down to the troposphere (4-4-5 2.) Al_2O_3 takes weeks to years to diffuse out of the stratosphere. We need to very carefully consider the cumulative effects of all of the launches worldwide and the ozone depleting effects of manufacturing pollution and automobiles etc."

USAF RESPONSE:

Cumulative air quality impacts were analyzed in Section 4.2.2 of the USAF EA. The expected release from worldwide space launches annually during the years 1998-2010 is 2161 tons of alumina particles and 1468 tons of inorganic chlorine (Brady, 1994). As noted in Section 4.2.1.2 of the USAF EA, the two USAF *ait* launches, proposed to occur eight months apart, will release 1.26 tons of alumina particles (Al_2O_3) and 0.956 tons of inorganic chlorine into the stratosphere. This equates to an annual contribution to worldwide space launches of 0.058 percent for alumina particles and 0.065 percent for inorganic chlorine should both the *ait* vehicles be launched in the same year. Furthermore, worldwide space launches represent 0.25 percent of the total inorganic chlorine produced in the stratosphere (Brady, 1994). These small amounts of emissions would not significantly contribute to a cumulative impact to stratospheric ozone. Section 4.1.3 of the FAA EA provides additional information on the negligible cumulative impact of launches from KLC. Based upon this comment, the Final USAF EA incorporates this information in Section 4.2.2.

FOUND IN DEFENSE ENVIRONMENT ALERT, 22 OCT 97:

BIOLOGICAL IMPACTS NOT FULLY ADDRESSED BY AIR FORCE, ALASKA CITIZENS SAY

Citizens near Kodiak Island, AK, disagree with the Air Force's findings in a draft environmental assessment (EA) that two test launches of missiles will have little impact on the area's environment, and plan to submit their objections in comments on the assessment, a citizen source says.

The Draft EA, released for public comment earlier this month, determined that the testing of two Minuteman II missiles from the planned Alaskan launch site "would not result in significant impact relative to air quality, biological resources, noise, health and safety, or hazardous materials and waste." Therefore, a more detailed environmental impact statement is unnecessary, the Draft EA says.

The construction and operation of the launch facility were the subject of an earlier Federal Aviation Administration (FAA) EA, which resulted in a finding of no significant impact last year. The Air Force examined the FAA EA in producing its Draft EA.

The Ballistic Missile Defense Organization has earmarked $18 million to build the site, which will be used to test the United States' ability to intercept an intercontinental missile shot from an Asian location such as North Korea.

But the citizens are concerned that the draft EA does not comprehensively address the possible impacts to the Steller sea lion and marine birds such as the Steller's eider, the citizen source says. Additionally, citizens fear that giving the environmental go-ahead for the Air Force could open the door for other military services to use the facility, possibly contributing additional military waste to Kodiak Island's 17 Superfund sites -- all the result of military activities -- the source says.

The Draft EA says safety and security lighting is not expected to attract bird strikes, noise impacts are "not expected to be significant," and the "chance of hitting even a single sea bird sitting on the ocean surface [with debris from a launch failure] is also remote."

While the draft EA concludes that any impacts on the Steller's eider would be minimal, the recent listing of the bird as a threatened species under the Endangered Species Act necessitates consultation with the U.S. Fish & Wildlife Service. The Air Force says it will participate in a monitoring program of sea birds, including the Steller's eider, which is commonly found in the area in winter.

The launch trajectory of the missiles is over an island that approximately 300 Steller sea lions use as a haulout during the late summer and early fall post-breeding period. The Draft EA says any

potential impacts would not interfere with the breeding cycle, although the animals may exhibit a startle response to the noise from the launch of the test missiles.

But citizens believe more study needs to be done on the biological impacts. "There has not been near enough time for the wildlife monitoring that was to take place for at least one year before the first launch," the citizen source says. "There is still insufficient information about the potential negative effects on the Steller sea lion haulout located less than 3 miles from the launch pad. More studies need to be done on the sea bird population, as well."

Citizens are also bothered by the Draft EA's failure "to consider the cumulative effects of these two [Air Force] launches in conjunction with other potential launches during the same time period," the citizen source says.

Another citizen concern is that the environmental studies used in the Draft EA and the FAA EA as reference do not address the unique climate of the sub-arctic.

Citizens had previously questioned why the Air Force did not use existing military facilities to test the missiles. The Draft EA says the Kodiak site is the only one that meets all of the necessary criteria. The Air Force did consider other sites, including sea- and airborne launches, existing DOD launch facilities, and locations in Alaska other than Kodiak.

The Kodiak site was originally designed as a commercial spaceport, and its construction is being supervised by a local civilian organization, the Alaska Aerospace Development Corporation.

RESPONSE TO COMMENTS
ARTICLE - DEFENSE ENVIRONMENT ALERT
INTERNET - OCTOBER 22, 1997

With the exception of the following two excerpts from this article, all comments contained therein have been addressed by other USAF responses.

COMMENT:
"Additionally, citizens fear that giving the environmental go-ahead for the USAF could open the door for other military services to the use the facility, possibly contributing additional military waste to Kodiak Island's 17 Superfund sites - all the result of military activities."

USAF RESPONSE:
The FAA EA section 1.2 states that the proposed KLC would make available infrastructure for placing telecommunications, remote sensing, military, scientific and research payloads in polar low-earth orbit. The FAA EA assessed the potential for up to nine launches per year from KLC and determined in section 4.12.2 that potential impacts associated with hazardous materials and wastes from launch operations would not be significant.

COMMENT:
"Another citizen concern is that the environmental studies used in the draft EA and the FAA EA as reference do not address the unique climate of the sub-arctic."

USAF RESPONSE:

The FAA EA took into account the climatology of Kodiak Island when assessing the construction and operation of KLC. In addition, as discussed in Section 1.2 of the USAF EA, one of the USAF *ait* siting criteria was weather conditions that are compatible with the launch of sub-orbital solid rocket test vehicles. The USAF considered the various weather conditions that occur at Narrow Cape on Kodiak Island.

ATTACHMENT 1
FAA ENVIRONMENTAL ASSESSMENT:
KODIAK LAUNCH COMPLEX